BUYER'S GUIDE: AMD FREESYNC 2 vs. NVIDIA G-SYNC

apc

YOUR EXPERT GUIDE TO TODAY'S TECH

May 2019
Issue 467

NOW INCORPORATING PC & TECH AUTHORITY

AUSTRALIAN PC AWARDS

THE WINNERS REVEALED

READER'S CHOICE FOR THE BEST PCs AND GEAR

GETTING STARTED WITH LINUX

ESSENTIAL OVERVIEW OF ALL MAJOR DISTROS

ULTIMATE GAMING LAPTOPS

NVIDIA RTX-GRAPHICS GROUP TEST

WINDOWS 10 POWER TIPS

100 ESSENTIAL HINTS, TIPS & SECRETS

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HOW TO GUIDES

CUSTOMISE MacOS TOOL BAR

PLUS MAKE STYLISED VIDEO CLIPS
> MAKE PHOTOS LOOK AMAZING
> SCAN AND DIGITISE PHOTOS AND DOCUMENTS

HOT TECH REVIEWS

EPSON ET-7700

BUSTING INK COSTS

PLUS NVIDIA GTX 1660
> HUAWEI P30 PRO > D-LINK D-FEND
> SURFACE HEADPHONES
& MUCH MORE

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Doing it all well

The winning way.

Our annual Australian PC Awards has now wrapped up, and we have a nice list of winners – you can see them all in our Awards feature starting on page 24 of this issue. The Awards are something we started over on *PC & Tech Authority*, and we were excited to bring it to the *APC* audience this time round.

As I watched the votes come in this year, I was struck by the dominance of a few brands. For many Award categories the winners were the larger brands, not the specialists. For example, Asus took it home for best router (with its ROG Rapture GT-AC5300) as well as best monitor (the ROG Swift PG27UQ).

What conclusion to draw from this? Well, in the router category specialists like TP-Link and Netgear came close to Asus, but not quite close enough this year. Similarly, monitor specialists like AOC also saw the gong to the Asus behemoth.

This year's awards also saw Corsair take home many wins – including the top tier Gold Award for Best Company.

Now, Asus definitely isn't a niche specialist, and debatably, neither is Corsair. Both companies have diversified successfully, with each of their product silos large enough to rank near the top in the world for range, performance and value. That doesn't come easily. Asus has been covering PC component categories for a very long time, and it's an enormous company with massive R&D spending. When it enters a new category it is a considered move and launch products usually impress. Corsair runs a relatively smaller outfit with fewer products but, again, almost all are executed well.

Does this mean we are living in an age of total dominance by a handful of major brands? Absolutely not! Looking closely at the results, the Asus PG27UQ was a beast of a monitor and was the first to combine all the new techs in a single product. It's no surprise it won. Similarly the GT-ACS5300 router also pioneered new tech and offered incredible performance. These votes made sense. You chose well.

But this time next year I wouldn't be in the least surprised if the tables turned, at least in some categories. We saw a big shift in the voting trends when comparing this year with last year's Awards. Results are impossible to predict and all I know for certain is that, as always, the year ahead will see amazing gear appear, perhaps coming from unexpected quarters.

But, ultimately, they're all fighting to bring us stuff that does more and costs less. It's difficult to identify any losers in this equation, really.

BEN MANSILL
EDITOR
ben.mansill@futurenet.com

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ISSUE 467, MAY 2019

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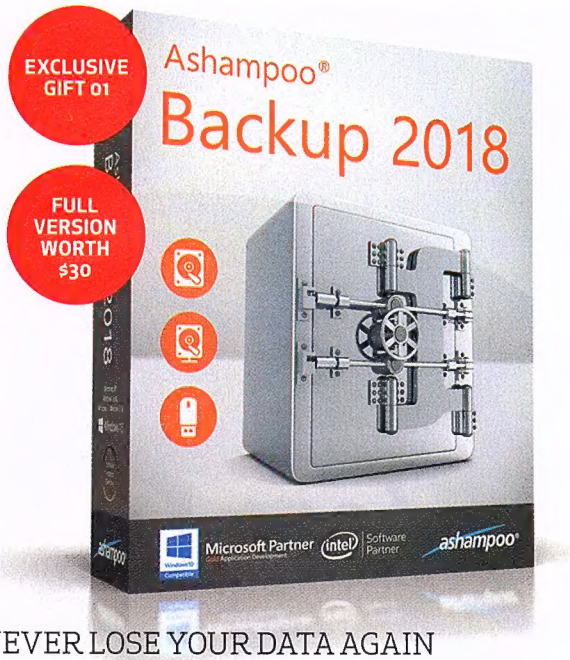

NEVER LOSE YOUR DATA AGAIN

GAIN PEACE OF MIND WITH ASHAMPOO BACKUP 2018.

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If you ever sat in front of a black screen because your Windows refused to start, you know the value of backups. Thankfully it's easy to make your data safe. Ashampoo Backup can perform entire disk partitions in just a few clicks and restore your files even in the event of a total system failure. This application was specifically designed to do the heavy lifting for you, that means safety without the need for constant user interaction or system slowdown. It's simple, it's fast and it's safe!

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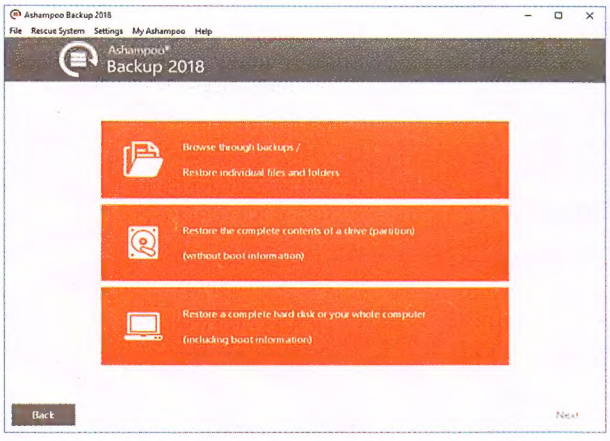
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One hasty mouse click at the wrong time and instantly you've lost important files. But not if you have a recovery tool like Abelssoft Undeleter at hand. Undeleter lists all recently deleted files which can be found in a specified drive, partition or folder. You can also set filters for the search, specifying which file format they're after, or to search for a particular word in the file names. Photos, documents, layout files, music or videos: thanks to the search filter you can stay clear of the vast, unorganised mass of deleted files. Once the desired file is located, a mouse click is all it takes to restore what would otherwise be lost forever.

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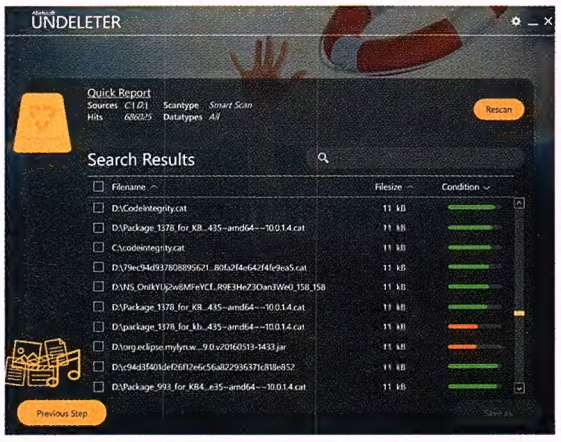

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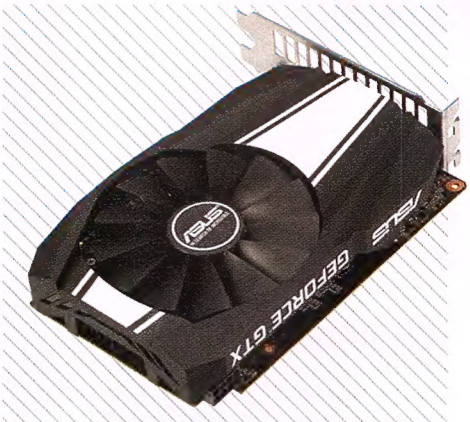

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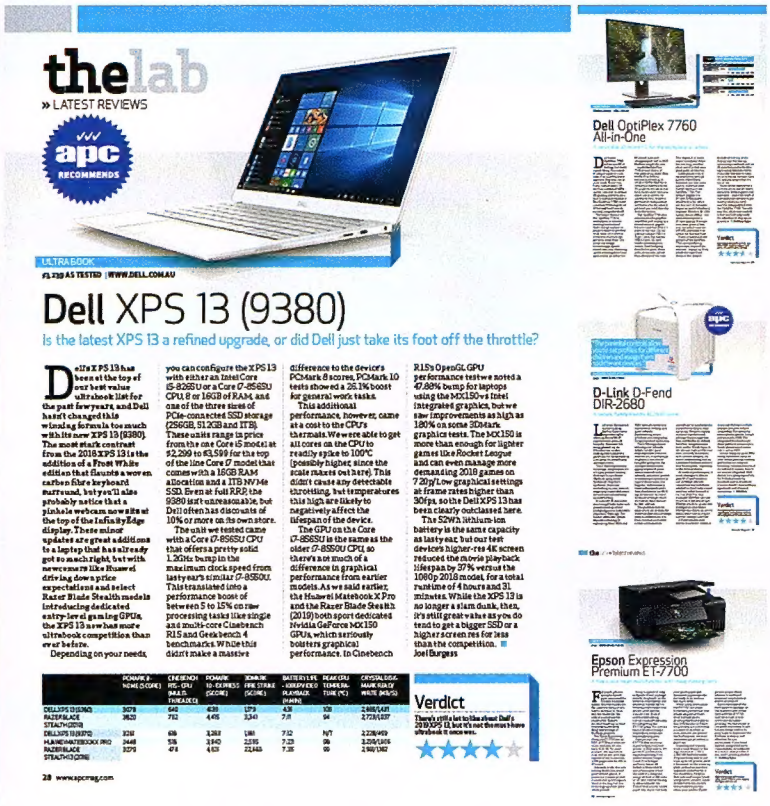
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Inside APC

Find out all about *APC*'s editorial policies, test practices, how to read the benchmark results, and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech, too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And, like you, *APC*'s journalists want to know what's good in tech – no matter what platform it resides on.

INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men and -women, however, and *APC* aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in *APC* are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an *APC* reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

Despite being a small magazine with limited resources, *APC* still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

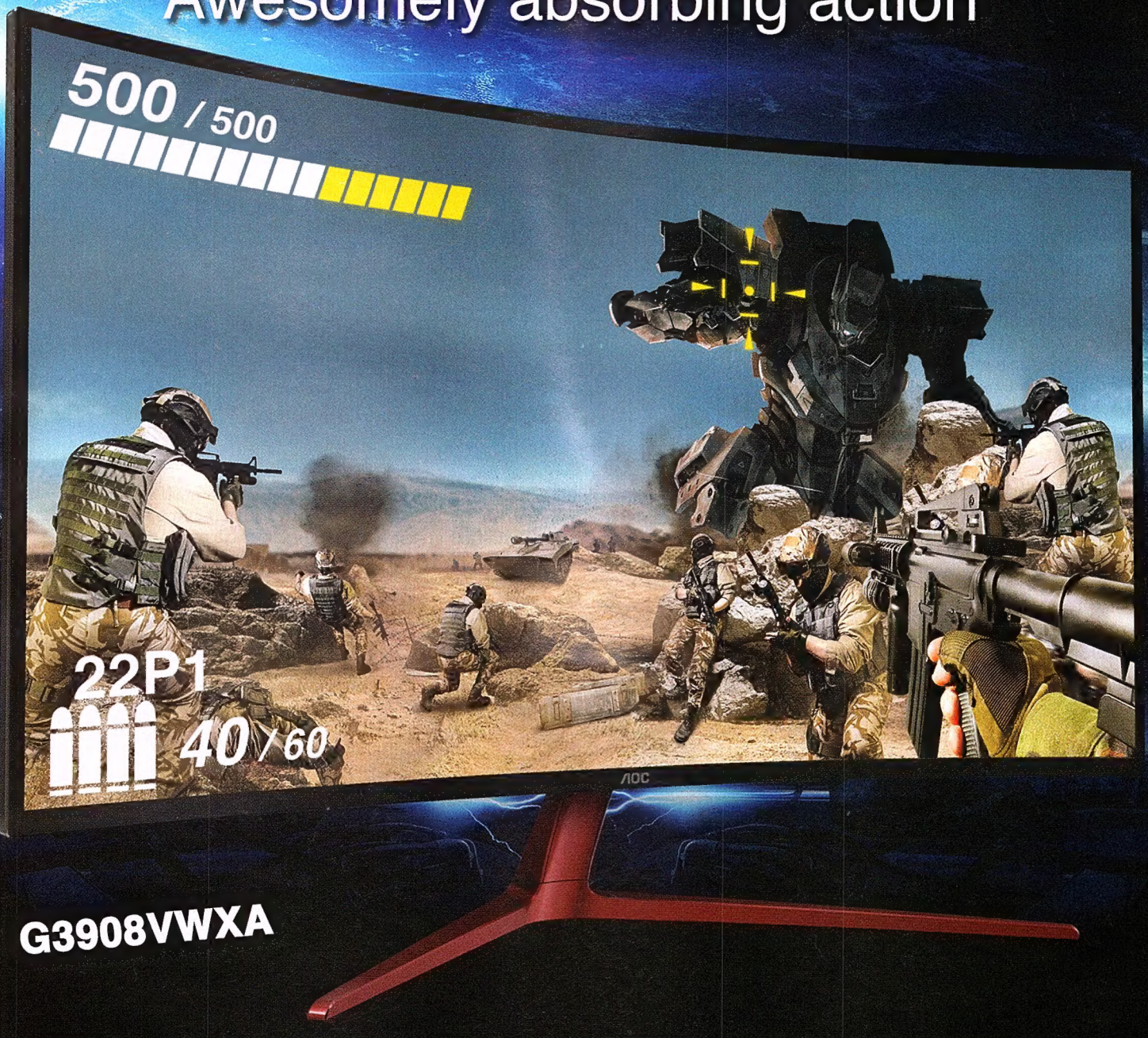
In most cases, for the benchmark results published in *APC*, you can assume that higher is better. There are certain tests that deviate from this rule where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.

AOC

SUPERSIZED SCREEN

Awesomely absorbing action



G3908VWXA

CURVED MONITOR

Curved screens offer a more immersive user experience that puts you at the centre of the action.

144Hz

144Hz refresh rate eliminates motion blur. Your display will be equipped to perform at the pro gaming standard.

AMD FREESYNC TECHNOLOGY

Adaptive Sync technology eradicates this disastrous problem by ensuring your monitor's refresh rate is always synced with your processor's. No tearing and no stuttering.

FLICKER FREE

Flicker Free technology uses a smooth backlight system to prevent monitor flickering and reduces eye strain and other damaging effects to your eyes.

LOW BLUE MODE

AOC Low blue mode puts the user first by reducing the screen's short wavelength blue light emission without sacrificing colour accuracy.

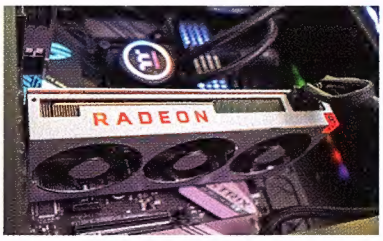
GAME COLOR

With AOC Game Color, you can adjust color saturation and grey levels across 200 levels of detail for a better game experience.

https://au.aoc.com/

technotes

» HARRY DOMANSKI WITH THE NEED TO KNOW NEWS



AMD's Radeon VII graphics card can now power Mac computers

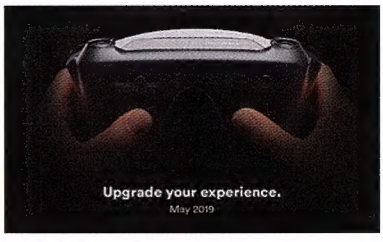
VIA EGPU, HACKINTOSH AND MAYBE EVEN FUTURE MAC PROS.

AMD's Radeon VII GPU has received support in the macOS Mojave 10.14.5 Beta 1 and has been tested to work in high-powered external GPU enclosures, although malfunctioned when inserted into a Mac Pro tower. Since the support is coming in the form of a beta update, it's not surprising there are flaws here, but it's still promising news for Mac users seeking more power.

NBN technicians are missing almost 500 appointments per day, on average

ALTHOUGH A THIRD OF THEM ARE JUST EARLY OR LATE.

NBN Co has reported that, between July 2018 and February this year, its technicians have missed 469 appointments on average each day, although a third of these are still completed at some point during the day, but outside of the acceptable five-hour window that the appointment should fall in.



Valve Index, a new VR headset, is set to launch in June

VALVE HAS CONFIRMED SOME DETAILS.

Valve, the company behind Steam game storefront, has teased a new VR headset titled the Valve Index. Since then, a spokesperson from Valve has confirmed some rumours about the new product, such as a targeted launch date in June, DisplayPort 1.2 and USB 3.0 connectivity, and a recommended GPU of Nvidia GeForce GTX 1070 or higher.

"Email scheduling will allow you to select a time and date for your message to be sent."

Loading Gmail

Gmail turns 15 and gets some new features, like message scheduling

Smart Compose arrives for all Android app users too.

On April 1, 2004, Google introduced its now-ubiquitous email service to the world – albeit on an invite-only basis – and with it came the promise of secure and fast messaging backed up with an impressive amount of storage. Gmail is now 15 years old and, for its birthday, Google announced a few updates for the service via its blog, including one that users have been eager to use for quite some time.

"We want to make it easier to respect everyone's digital well-being," Google's blog post reads, "so we're adding a new feature to Gmail that allows you to choose when an email should be sent." Email scheduling will allow you to select a time and date for your message to be sent, accessible by clicking the arrow next to the regular 'send' button. Google is also expanding its Smart Compose functionality to all Android devices using the Gmail app (with iOS coming soon), as well as introducing compatibility for four new languages – Spanish, French, Italian and Portuguese.

NBN's lowest speed tier is set to get more congested and expensive

PAY MORE OR SLOW DOWN.

It's no secret that NBN Co would like consumers to sign up to the higher speed tiers on offer, having designed multiple initiatives to encourage the uptake of NBN50 or higher, but its next move will instead actively discourage people from choosing the lowest tier. As reported by *IT News*, NBN Co is looking to discontinue a 'discount' it had in place with Retail Service Providers (RSPs) which effectively made NBN12 (12Mbps) speeds affordable to consumers. This means that, we could start seeing congestion on the lowest NBN speed tier network in coming months, as well as costs of the NBN12 plans rise once again, after they had been brought down to a reasonable amount with the initial discount introduced in mid-2016. The discount worked by reducing the charge for Connectivity Virtual Circuit (CVC) bandwidth, which allowed RSPs to redirect excess traffic from its NBN connections to its own network, but with that gone it's a less viable option overall.

msi
Discovery
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SLIM · ELEGANT · PRESTIGE
4-Sided Thin bezel
1.6kg
Ultralight
16 hrs
Productivity up to 16 hrs
| UP TO 8th GEN. INTEL® CORE™ i7 PROCESSOR |
| WINDOWS 10 HOME / WINDOWS 10 PRO |
| UP TO GEFORCE® GTX 1050 WITH MAX-Q DESIGN |
PRESTIGE series

Aussie-made family-tracking app was leaking location data

REAL-TIME UPDATES EXPOSED FOR ALL TO SEE.

An app called Family Locator was found to be leaking the real-time location of some quarter-million users recently. While the app was intended to keep tabs on where your family members were at, security researchers found its exposed database contained unencrypted info on the users' name, email, photo, password and current location, even revealing the name of such location, for instance: 'home'.

Drunken online shopping in the US accounts for roughly US$48 billion a year

WITH CLOTHING BEING THE MOST COMMON PURCHASE.

A survey of 2,000 US adults has found that, on average they spend US$400 each year on online purchases when intoxicated – extrapolate this, and you get US$48 billion spent by all adults of legal drinking age in the States. An overwhelming majority of these purchases are from Amazon (it being four times as popular as eBay), and most of the purchased goods are clothing items.

Google+ public posts have been saved forever thanks to the Internet Archive

WERE YOUR POSTS PRESERVED?

Following the failure of its social media platform, and a spate of security breaches, Google commenced deleting all data from Google+, but there were those who intended to preserve its somewhat underwhelming legacy. *The Internet Archive* is cataloguing any public posts – text, comments, images and more – for the sake of posterity, so if you've got anything you didn't want to be made eternal, it might be too late now.

"Singapore announced a 'fake news' bill which allowed the government to imprison or fine individuals or companies large sums of money for making or spreading "false statements of fact"."

Facebook looking to restrict livestreams, open to more regulation

THE SOCIAL NETWORK SAYS IT'S AWARE OF ITS ISSUES.

In response to the recent terror attack in Christchurch, Facebook has again attempted to propose a solution to the inherent role it plays in being a platform for bad actors. The company's Chief Operating Officer, Sheryl Sandberg, recently published an open letter in which she says the service is "exploring restrictions" for limiting who can launch livestreams, for instance. New measures will look at whether a user has previously violated community standards before they go 'Live', and new identification technology is being looked at to faster identify edited versions of offending content that has been re-shared by others.

CEO Mark Zuckerberg has also made a blog post titled *"Four Ideas to Regulate the Internet"*, which essentially urges governments around the world to have a more active role in regulating harmful content, election integrity, privacy and data online. It's worth noting that each of these 'ideas' are explicitly linked to scandals or major issues that the social media giant has encountered in the last year or two, often alongside accusations that it is indeed Facebook's responsibility to handle these issues.

While Zuckerberg claims he is "looking forward to discussing the [ideas] with lawmakers around the world" in this post, merely days after it was published, it seems he may regret it. Shortly after Facebook's post was made, Singapore announced a 'fake news' bill which allowed the government to imprison or fine individuals or companies large sums of money for making or spreading "false statements of fact". With Facebook's Asia-Pacific headquarters based in the city state, a spokesperson has stated that, while they support the principle of regulation, they have concerns at the new law's ability to grant its government "broad powers" of control over online media. Singapore is known for having an anti-press attitude, with a world press freedom ranking of 151 out of 180 countries, according to Reporters Sans Frontieres, so it's not a far stretch to see how this new bill could be abused by the authorities to suppress freedom of opposition and political discourse. ■

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techbrief

» SHARMISHTA SARKAR TAKES A DEEPER LOOK WHAT'S TRENDING IN TECH.

Video streaming in Australia: is there such a thing as too much content?

Make all your streams come true.

During a star-studded announcement in March, Apple unveiled its new video streaming service to the world. Apple TV+ will stream original shows and movies ad-free to over a billion users of its own devices and smart TVs worldwide. While the tech giant might want to give the likes of Netflix and Foxtel a run for their money, its business model is a little different – alongside original content, in the US Apple TV+ will also offer paid channels from HBO, Starz and Showtime. The paid subscriptions will be available on the revamped TV app first (in May), while Apple will begin streaming original content towards the end of 2019.

Apple won't be the only new kid on the block, though. US companies Walt Disney (having bought 21st Century Fox) and AT&T (which owns Time Warner) also have plans for their own streaming services, perhaps begging the question "How much video content can we take in at once?"

So many choices: Choosing the best streaming service for you

Netflix vs Stan vs Amazon Prime vs Foxtel Now.

When combined, Netflix, Stan, Foxtel Now and Amazon Prime offer an enormous range of films and TV shows that can be instantly streamed. However, if you can only afford one service, narrowing down a definitive choice can be hard. Though each has its own strengths and weaknesses, Netflix is unquestionably the winner when it comes to device compatibility, original content and stream quality. Its library of Netflix Originals continues to grow and maintains a high level of quality.

With Disney productions also available on Stan, similar pricing to Netflix and HD quality streams to boot, for some households it could be hard to choose between the two. It's great that Amazon Prime Video has made its way to Australia, and while it still has a long way to go in terms of growing its content library and number of compatible devices, it continues to add new flicks and shows constantly. On the plus side, the service is quite inexpensive. We love the sheer amount of video available on Foxtel Now, though getting a decent selection up will hurt your wallet in the long run.

Australia now also has a streaming service dedicated solely to sports. Kayo Sports is a sister product to Foxtel and mirrors almost everything on a Fox Sports package, but without the added cost of said package.

Australia's consumption of video streaming content is insatiable

And we're only getting hungrier.

While Netflix might get the lion's share of Aussie subscribers, we're not opposed to a bit of Stan on the side. As of June 2018, the Australian subscription video-on-demand market grew 54% over the preceding 12 months, soaring to 9.1million subscribers. At the time, Telstyle estimated Netflix had 3.9 million subscriptions, but by August 2018 it was predicted that Netflix would soon cross the 10 million mark. According to 2018 estimates from Roy Morgan, over 13 million Australians have access to some form of streaming service, even if it's just ABC's iview, putting us in sixth place in terms of global video streaming penetration rate.

How much data does video streaming use?

That stream went data way...

The easiest way to get an idea of how well your home broadband can handle video streaming is to use open a YouTube video and manually select different resolution qualities. If you see no issues at 720p or 1080p, you'll easily be able to stream high definition videos on a paid streaming service.

If you're worried about how much data streaming videos will consume, most services have the information available on their websites. It varies slightly across services, but streaming in standard definition typically uses about 700MB to 1.4GB of data per hour. Most platforms now offer HD streams as well, which use approximately 3GB of data for each hour of streaming.

While not all services offer 4K video, the popular ones do, and it can take up to 7GB of data per hour to stream UHD content.

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gadgets

» GOOD GEAR

EPSON MOVARIO BT-350

We see right through you.

US1,099 | EPSON.COM

Epson's updated its well-entrenched Movario AR glasses. The new Movario BT-350 has improved optics, a more comfortable and adjustable frame. We recently sampled the Movario BT-350 at the Australian GP where we could move around a Mercedes car while info popped up, depending on where we were looking. Look at the hood, for example, and an animated cutaway of the engine beneath appeared, along with specs and info. Movario AR glasses are used widely in education, engineering and design, and are especially popular with drone pilots, overlaying the drone's view plus flight data over your view of the real world.

AIRPODS 2

Apple's wireless buds get a second wind.

$319 | WWW.APPLE.COM/AU

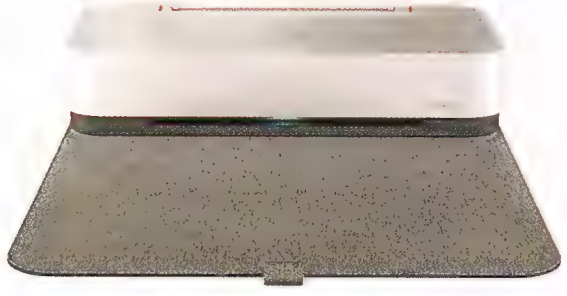
Whilst Apple's AirPods still hold up well as true wireless headphones, Apple's AirPods 2 announcement in March revealed a number of worthy upgrades. Apart form a new case with Qi-charging, the next generation true-wireless earbuds will each have a new H1 processor. Apple has built this chip specifically for its wireless headphones, a customisation that reportedly cuts pairing time and boosts efficiencies by up to 50% more talk-time. There's a few other minor tweaks like hands-free 'Hey Siri' commands, better voice isolation software and on-headphone touch controls. That mean the AirPods 2 are definitely an improvement, but it's not a big enough shift to bother upgrading if you have the original AirPods.

HP TANGO X

Can HP spin the image of consumer printers around?

$279 | HP.COM.AU

While physical documents are becoming less and less relevant, there's still plenty of occasions where you'll need to print something out. If you're anything like us, though, then this need is outweighed by the large and uninspiring consumer printers that are readily available. HP is looking to solve this by making printers stylish again. The new HP Tango X is a sleek printer-and-scanner combo that takes up as little space as possible and tucks away neatly behind a minimalist felt cover. There's other modern additions, like a handy app interface and remote printing, and you can even use your preferred voice assistant to print, although we're not sure how useful that last one is just yet.



DYSON V11 CORDLESS VACUUM

The successor to Dyson's most powerful cordless vacuum.

$1,099 | DYSON.COM.AU

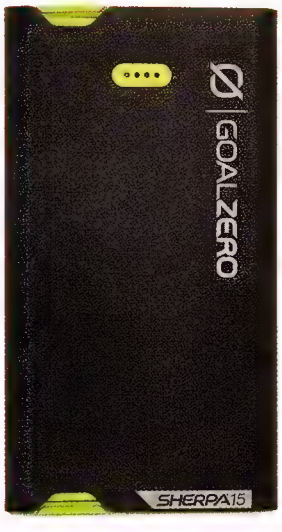
It's pretty rare for us to pine for a vacuum cleaner, but if there's one company that can dazzle techies enough to keep them listening to a vacuum cleaner pitch it's Dyson. The V11 is the follow up to Dyson's most powerful cord-free vacuum, and it somehow manages to suck even harder (20% harder to be precise). This is thanks to a more efficient motor, but there's also a set of redesigned heads and Dynamic Load Sensors that rake in even more particles. The new battery offers up to 60 minutes of 'fade-free' cleaning and an updated display now relays the exact run time you'll get from the mode you're in.

THE NORTH FACE KABYTE

The perfect commuter backpack.

$200 | THENORTHFACE.COM.AU

This very utilitarian looking laptop backpack is forged from 900D polyester with TPE PVC coating. Externally the only features are a water bottle pocket on one side and a carry handle up top. The shoulder straps are form moulded and the back panel is nicely padded and features a spine channel for comfort. The Kabyte has a fairly narrow depth to hold, carry and distrbute loads close to the body – perfect for crammed peak-hour all-stops trains or a cycle commute for unhindered peripheral vision. The Kabyte is a slick-looking laptop backpack with a surprising amount of space given its diminutive 20L size, and that's down to its clever internal organisation. Firstly, there's a dedicated, padded laptop sleeve – complete with ejector handle for easy access – plus a main compartment that also has an assortment of quick access organisation pockets as well as more dedicated "media" pockets. A great little commuter backpack and definitely more than meets the eye!



GOAL ZERO SHERPA 15 POWER BANK

Portable powerhouse.

$79.95 | WWW.CYGNETT.COM

The only time your phone or tablet will run out of charge is when you desperately need to use it for (presumably) kitten pic-related things. The baby in the Sherpa range, the 15, is an emergency device charge option which has the convenience of built-in cables (both lightning and Micro USB). It features 3870 milliamp hour thin-pack lithium technology. If you use it like us, multiple short burts of juice are enough to finish off a trip before you get your phone on mains. The chasis is crafted from seamless extruded aluminum and measures in at a lithe 12.7 x 6.85 x 1cm, making it virtually unnoticable tucked inside your daily commuter bag. ■

howit'sdone

Google Pixel 3 XL

Man vs glue.

This vibration motor is said to be improved, providing more precise haptic feedback.

There's plenty of adhesive inside, but some is easier to work with than the rest.

The Google Pixel 3 XL is all dressed up in the latest flagship phone uniform: glass on the back and a notch on the front. But we're headed past the shiny new facade for a closer look at the insides.

MAJOR TECH SPECS

- 6.3-inch OLED display with QHD+ 1440×2960 resolution (523 ppi) and Gorilla Glass 5
- Octa-core 64-bit Qualcomm Snapdragon 845 processor (2.5GHz + 1.6GHz) with 4GB LPDDR4x RAM
- 12MP f/1.8 OIS main camera with dual-pixel phase detection autofocus; dual 8.1MP selfie cameras
- 64GB or 128GB built-in storage
- Qi wireless charging
- IP68 water resistance
- Android 9.0 Pie

KEY FINDINGS

- We need to bring out the big (heat) guns to open the display. It looks like the Pixel 3 XL still uses foam adhesive, but it's far more tenacious than the repair-friendly stuff from last year. We grab the iSclack, expecting to separate the display assembly, but the rear cover yields first.
- Thankfully, the fingerprint sensor cable is long enough to avoid being torn by over-zealous openers. Inside is pretty much as expected: a new wireless charging pad, a battery, a board, a couple cameras, and a fingerprint sensor on the rear cover. Less expected are metal covers over the mobo, and a SIM tray hidden beneath the speaker assembly.
- The tough adhesive trend continues, holding the wireless charging coil to the Pixel's powerhouse, but the battery is secured with relatively repair-friendly stretch-release adhesive. We resort to flossing out the battery, but cut a fragile hidden ribbon cable by accident. Forewarned is forearmed — a repair manual would have helped here.
- Above the crater where the battery once lay, we extract an antenna shielding the motherboard. On the south end of the phone, we battle more adhesive to release what seems like another shield, but is the speaker housing, which we split in half trying to access the components below. The speaker chamber is sealed with waterproofing adhesive, and that seal has to be broken to access any of the commonly serviced ports on the daughterboard.
- With its shields down, we finally get a look at the newest Pixel's motherboard. As the board comes out, we can't help but notice generous helpings of thermal paste on its underside, to transfer heat from the hardest working chips to the metal frame. The daughterboard comes out without fuss, taking the USB-C port, SIM tray, and some antenna hardware with it. The vibration motor is more reluctant to leave home, but our Halberd Spudger is very persuasive.
- Repairability score: 4 out of 10 (10 is easiest to repair). The only screws are standard T3 Torx ones. Repair-friendly stretch-release adhesive secures the battery. O-rings and adhesives for waterproofing complicate repairs, but make difficult liquid damage repairs less likely. Display repairs are trickier than on previous models, requiring complete disassembly of the phone. To service any component, you must painstakingly unglue the rear panel. Front and back glass means increased vulnerability to drop damage. ■

enduser

» SHAUN PRESCOTT DIGS INTO THE BIG TECH ISSUES.

Epic CEO Tim Sweeney.

PC gaming is in the first stages of immense change

With Epic Games and Google breathing down its neck, Valve should be worried, writes Shaun Prescott.

When Epic Games, the powerhouse game development studio behind Unreal Engine 4 and *Fortnite*, announced it would launch its own PC games shopfront last December, few believed it would ever rival Valve's Steam. Fast forward four months, and with Epic having secured high-profile blockbuster exclusives such as *Metro Exodus*, *The Division 2* and *Borderlands 3* – not to mention a slew of bigger indie titles – the prospect that the PC gaming market might soon change irrevocably seems more and more feasible.

Epic CEO Tim Sweeney hasn't been coy about his company's intentions to thwart Steam. He told MCV in March that the only way to "displace" the storefront was to secure high profile exclusives – a feat that probably couldn't be achieved had *Fortnite* not filled its coffers. Whatever the case, not all consumers are happy about Epic Games' efforts, with online sentiment siding with Steam (though, admittedly, this might be a vocal minority). It's easy to see why: for those who have amassed a large digital library with Steam, it must hurt to have that inventory separated across platforms. Not to mention how barebones Epic's shopfront is at the moment, though a recently released roadmap suggests it'll have most of the fundamentals by mid-year.

Still, it's an interesting time for PC gaming. When Valve bundled Steam on *Half-Life 2* retail discs in 2004, many were suspicious of it. What was this launcher, and why exactly wasn't it a form of malware or bloatware? Since then it's made Valve an immensely wealthy company, and most have come to associate PC gaming with it. So is Valve rattled by Epic's move?

A traditionally secretive and aloof company, Valve was prompted to comment on the removal of *Metro Exodus* from its platform following the Epic Games agreement, calling it "unfair" on its customers. Developers are increasingly wary of Valve's 30% cut from sales of software on Steam, and more broadly, Valve's approach to curation has become virtually non-existent, leading to games like *Rape Day*, a visual novel glorifying sexual violence, appearing on the shopfront for a while (it was later removed, but only after a week's deliberation by Valve).

The likes of Gabe Newell and Tim Sweeney have both, at different times and under different circumstances, advocated for the PC as an open platform. But that doesn't mean a company's PC shopfront should sell every objectionable thing. And while Steam has become a one-stop destination for everything from the latest Ubisoft title through to independently developed sex games, its trajectory seems to demonstrate that some form of curation is needed. At least, that's what commentators and vocal consumers have been saying.

This time last year the prospect of a Steam usurper would have seemed laughable. But then, things are changing faster than many can comprehend: Google's game streaming service, Stadia, will no doubt pose an existential threat to storefronts in the event that it takes off. ■

END USER

Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at **apcmag@futurenet.com**. All correspondence becomes the property of *APC* and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

epinions

"It seems many models available internationally aren't sold here. Are we just getting the dregs at inflated prices?"

AUSTRALIA MATTERS

I just read in the April edition of *APC* about the Razor Blade Stealth for $2,500 and it only has a 250GB SATA 3 SSD and 8GB RAM. I searched and searched for a decent gaming ultrabook on Australian websites and in stores and couldn't find one. I got one from Taiwan via the Kogan store for $2,000. It came with an Aussie power plug and an Australian warranty. It's an Asus 14-inch with 500GB NVME M2 drive 16GB RAM 2GB video card and fast Core i7 quad core processor, three USB 3 ports, full size SD slot for my photos, USB C port and mini HDMI to connect to TV.

The bottom has four screws and underneath you can easily replace the hard drive and RAM if you want to upgrade. I might consider moving to a 1 or 2TB NVMe drive as prices eventually come down!

That was over a year ago and I still haven't seen anything sold here for similar specs and price. All I can find are higher priced and lower-specced models. It seems many models available internationally aren't sold here. Are we just getting the dregs at inflated prices? I am told by those in the clothing and footwear industry that that is often the case – end of lines and things that didn't sell overseas are dumped here!

Philip

Ben Mansill replies: *Thanks for your thoughts, Philip. Generally speaking Australia is close to first in line for new tech gear, and that especially applies to laptops. I'm frequently told at international events that Australia is one of the three most important regions in the world and that's because we're famous as early adopters. So, companies try and get new gear to our market quickly. What we don't see is the entirety of a company's product line, usually, but that's normal. In the UK and US , for example, there are models we don't see here, and vice versa.*

Any new laptops that come through an official distributor will generally be on par with the rest of the world for specs and relative pricing.

LOVES IT TO BITS

I decided to un-install Eset and give BitDefender a go. I expected it to be sluggish and boring but, boy, was I wrong! BitDefender is not slowing down my PC and, wow, it's loaded with features. I loved it so much I subscribed for three years to the Internet Security Package. It even has a password manager thrown in at no extra cost for kicks!

I tested the firewall at shields-up and it passed with flying colours with all ports stealth. I flew some malware at it and it was bulletproof. Heck, it even denied me many malicious websites! This is a very, very good suite. Just get rid of the auto-payments by default and they are on to a winner here.

I'm very impressed! Can Norton actually be even faster? My system is like a ninja for responsiveness now. My system runs faster than if Eset was installed and that is a first.

Ryan ■

APCMAG@FUTURENET.COM

Come on, have your say!

We want to hear what you think. Add to these discussions or email your views (in fewer than 250 words) to **apcmag@futurenet.com**. All correspondence becomes the property of *APC* and is subject to editing. Letters must include full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

USBS

As if the current USB naming scheme wasn't bad enough, it's about to get worse. Chris Szewczyk looks at the confusing USB 3.2 standard.

The USB Implementers Forum (USB-IF), the governing not-for-profit body that oversees USB has released the USB 3.2 specification. On the bright side, we'll get a 20 Gb/s specification. More bandwidth for data hungry devices is always welcome. Devices such as docking stations, external SSDs and displays can all benefit from the increased bandwidth.

Naming the 20 Gb/s connection USB 3.2 would be logical. Unfortunately logic is not a part of the USB-IF's naming schemes. If we had USB 3.0 for the 5 Gb/s connection, USB 3.1 for 10 Gb/s and now USB 3.2 for 20 Gb/s, well, that just make sense! That's not what's happening though. USB 3.2 is rebranding all prior 3.x specifications exactly like we saw with the release of USB 3.1. USB 3.0 becomes USB 3.2 Gen 1, USB 3.1 becomes USB 3.2 Gen 2 and USB 3.2 at 20 Gb/s is actually named USB Gen 2x2. Confused? So are we! What if a non-tech savvy user looks at a device and sees it supports USB 3.1 Gen 1. Will they know that it's the same as USB 3.2 Gen 1?

We hope the average consumer won't end up having to decipher these names as the USB-IF is pushing for consumer friendlier branding. USB 3.2 Gen 1 will be branded SuperSpeed USB, USB 3.2 Gen 2 will be SuperSpeed USB 10 Gb/s while USB 3.2 Gen 2×2 will be SuperSpeed USB 20 Gb/s. If these names become widely adopted then things will be easier. However, SuperSpeed branding already exists and is not widely used, so it remains to be seen just what consumer-friendly naming USB 3.2 will take.

Speeds are one thing, but there are several other things to consider. The Type-C connector is not yet widespread compared to Type-A. Mini and Micro USB connectors are still widely used. The different USB standards have different power delivery capabilities. Can/should a bargain basement generic hub be used to supply up to 100W to one or more devices? When you consider all these things, USB is not so universal.

A typical end user needs clarity and simplicity when it comes to using their everyday tech devices. Exactly what your phone, tablet, PC or laptop supports has become harder to decipher. It's important to note that backwards compatibility remains, however all this confusing branding, different connector types and sub-standards are a headache for users who just want to plug their devices in and have them work. Let's bring the universal back into Universal Serial Bus.

Did we mention that USB 4 is incoming? Will sanity prevail? We'll have to wait and see.

On an unrelated note, last month we reviewed the Western Digital Black SN750 NVMe SSD. We thought it offered a stunning price/performance ratio at $279 for the 1TB model. However, it turns out that the drive was released at $329 which puts it right back in the pack. We assume the pre-release pricing we were given was simply an honest mistake. ■

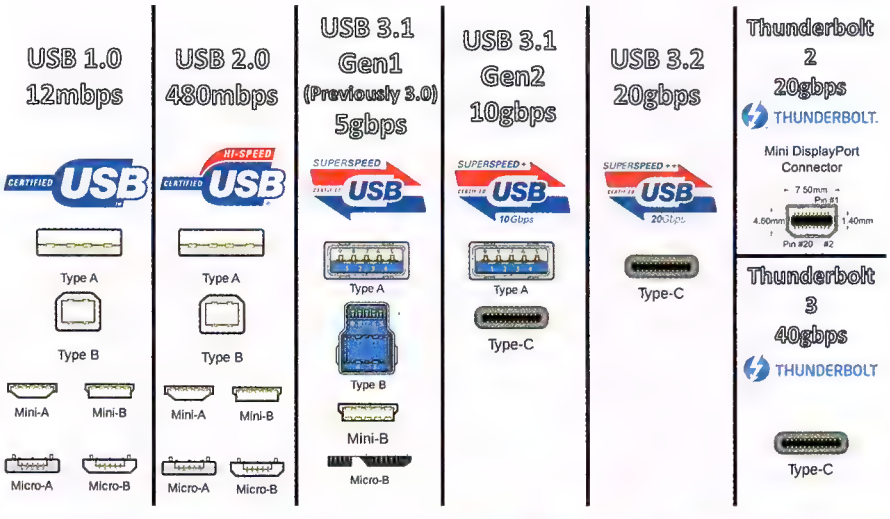


IMAGE CREDIT: MadSpacePig

"A typical end user needs clarity and simplicity when it comes to using their everyday tech devices. Exactly what your phone, tablet, PC or laptop supports has become harder to decipher."

AMD FreeSync 2 vs. Nvidia G-Sync

The battle for silky frames.

The contest between G-Sync and FreeSync adaptive refresh tech is Nvidia versus AMD in a nutshell. G-Sync is proprietary and expensive, while FreeSync relies on open standards. Nvidia says that having full control over G-Sync enables a better experience, while fans of FreeSync note that the latest standard adds a range of additional capabilities. What's more, Nvidia has now unlocked FreeSync compatibility for its GPUs, putting a new spin on things.

Round 1

INNOVATION

This has to go to Nvidia. It was first to market with G-Sync in 2013. G-Sync gets a hard rap for its proprietary nature, the need for expensive modules in the display, and the fact that G-Sync only works with Nvidia GPUs. But in 2013, something along those lines was the only way to make adaptive refresh possible in a desktop scenario. AMD responded within six months with FreeSync. Problem was, in that early form, FreeSync was only possible courtesy of the variable refresh profile in embedded DisplayPort (eDP), a feature designed for power saving rather than making games more slick. By May 2014, AMD and the standards body VESA had worked together to add adaptive refresh as an optional extra for the 1.2a iteration of DisplayPort, and it was game on. You could argue that FreeSync 2 has since upped AMD's innovation ante. You might even take the view that G-Sync has meanwhile stagnated, which is why Nvidia eventually caved, and added FreeSync support to its 3D boards. But it's also possible none of this would be happening had Nvidia not blazed a trail with G-Sync. So, we're happy to give Team Green the nod on this one.

WINNER:
G-Sync

Round 2

COMPATIBILITY

The obvious winner is FreeSync – it's based on open standards, and makes fewer demands of monitor makers. It's essentially a part of the DisplayPort standard, rather than tied to a graphics vendor. What's more, with Nvidia now supporting the VESA adaptive refresh interface with its graphics cards, FreeSync now works with both AMD and Nvidia GPUs. G-Sync, meanwhile, is locked to Nvidia boards, and demands that monitor makers integrate an expensive scaler module. The slight complicating factor is that FreeSync 2 sets out a broader array of requirements for compliance. Simply including the latest DisplayPort interface no longer cuts it. Features like HDR support and low frame-rate compensation certainly up the appeal and capability of FreeSync displays, but they also make it harder for monitor makers to create compatible displays. It's also worth noting that only Nvidia graphics cards deliver support for both G-Sync and FreeSync. So, it's not an absolute and unambiguous win for AMD, but FreeSync is the more open platform. When Intel enters the market and supports FreeSync, the end will probably be nigh for G-Sync.

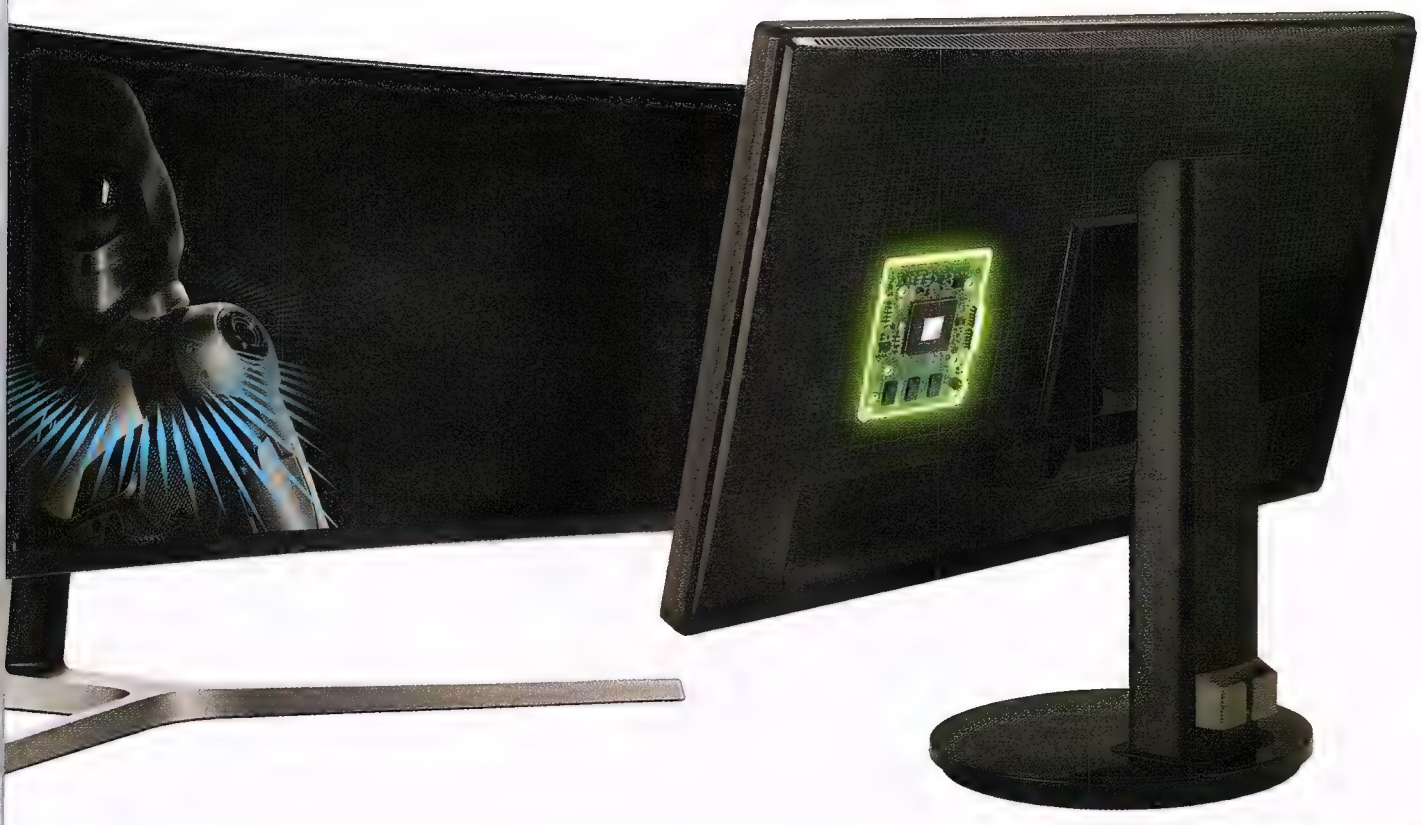
WINNER:
FreeSync 2

Round 3

VALUE

The value proposition of G-Sync is problematical. That's because it's a proprietary hardware solution, while FreeSync is standards based. G-Sync requires a special scaler module that contains an Altera Arria V GX family FPGA featuring 156K logic elements, 396 DSP blocks, and 67 LVDS channels. Produced by TSMC on its older 28LP process, and paired with three DDR3L DRAM chips, the result is a fair few middle men, and quite a bit of margin taking that the end user must fund. Thus, G-Sync monitors tend to cost at least a hundred dollars more than otherwise comparable models. In the early days, the justification for that was quality of experience. With G-Sync, you had a monitor that had been honed and optimised, particularly when it came to combining adaptive refresh with pixel overdrive. Early FreeSync panels were patchy, with some suffering from ghosting. FreeSync implementations are now more consistent, making the value proposition of G-Sync more questionable. However, for FreeSync 2, the more extensive requirements for qualification put upward pressure on pricing, even if you do get more features for your money than G-Sync.

WINNER:
FreeSync 2



Round 4

GAMEPLAY

This, surely, is what it's all about: delivering buttery smooth, tear-free gaming. G-Sync is expensive and locked to Nvidia hardware, but the payoff is the slickest, most polished gaming experience possible, right? It's certainly true that G-Sync was the more reliable solution in the very early days. Nvidia put significant work into making G-Sync as polished as possible. That included not only optimising it to function properly with pixel overdrive, but also features such as so-called collision avoidance, designed to help in low-frame-rate conditions, where the panel is being updated with duplicate frames as a stop-gap while waiting for a new frame to be rendered. It uses algorithms to avoid a scenario where a new frame is ready but has to wait for the panel to finish being updated with a duplicate frame. FreeSync has its own solution: Low Framerate Compensation support. This broadens the range of refresh rates over which FreeSync operates, and ensures better performance at lower frame rates. It used to be an optional feature; with FreeSync 2, it's compulsory. So, there's now nothing in it from a subjective gameplay experience perspective.

WINNER:
Dead heat

Round 5

ADDITIONAL FEATURES

Are there other features that aren't directly related to achieving and optimising adaptive refresh rates that might tip the balance? That's not a straightforward question to address, partly thanks to an arguable lack of clarity around G-Sync's specifications and requirements. You'll see references to G-Sync HDR monitors, for instance, but that, ultimately, refers to a G-Sync monitor with added HDR capability. HDR is supported by G-Sync, rather than being required by it. For FreeSync 2, however, HDR is very much a marquee feature. In fact, FreeSync 2 takes a novel approach to HDR rendering. The conventional approach involves tone mapping the requisite dynamic range twice, first in the game to comply with an HDR standard like HDR10, and then again in the monitor to map from HDR10 to the monitor's native dynamic range. FreeSync 2 simplifies that by enabling games to tone map directly to a monitor's native dynamic range. In theory, this can save a few precious milliseconds and improve response in HDR games. In practice, it requires specific support from game developers, which is less than ideal.

WINNER:
FreeSync 2, in theory

And the winner is...

In the very early days of adaptive refresh tech, it was difficult not to give the nod to Nvidia's G-Sync. There were decent implementations of FreeSync monitors from day one, but if you had to pick G-Sync and FreeSync monitors at random, you could rely on the G-Sync option delivering a good experience. FreeSync? Not so much. That's no longer the case. Even before FreeSync 2 arrived, most FreeSync monitors were delivering the goods in terms of a smooth, slick gaming experience without any obvious image quality problems. With FreeSync 2's required LFC feature, plus some low latency goodies, the gap has closed to nothing from a gameplay perspective. That, no doubt, is at least part of the reason why Nvidia has unlocked FreeSync support for its GPUs. The move is a tacit admission that the end is nigh for G-Sync. As a proprietary technology, it must be unambiguously better than the open-standard alternative. If that ever was the case, it isn't any longer. Which is why FreeSync 2 not only wins our contest, but it will almost certainly end up dominating in the real world.

Announcing the 2019 Australian PC Awards winners

Recognising and rewarding the very best in PC gear.

THE WINNERS

BEST BUDGET MOTHERBOARD OF 2018
FINALISTS:
Asrock B360M-Pro4, Asus ROG Strix B450-F Gaming, Gigabyte B360 Aorus Gaming 3 WiFi, Gigabyte B450 Aorus Pro, MSI B360 Gaming Pro Carbon

WINNER:
ASUS ROG STRIX B450-F GAMING

BEST PREMIUM MOTHERBOARD OF 2018
FINALISTS:
Asrock X470 Taichi, Asus Prime X299 Deluxe II, Asus ROG Maximus XI Formula, Gigabyte Z390 Aorus Master, MSI MEG X399 Creation, MSI MEG Z390 Ace

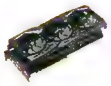
WINNER:
ASUS ROG MAXIMUS XI FORMULA

BEST MOTHERBOARD COMPANY OF 2018
FINALISTS:
Asrock, Asus, Gigabyte Aorus, MSI

WINNER:
ASUS

BEST BUDGET GRAPHICS CARD OF 2018
FINALISTS:
Asus Expedition Radeon RX570 eSports, Asus GeForce GTX 1050 Ti Cerberus OC 4GB, Gigabyte GeForce GTX 1050 OC 3G, Gigabyte GeForce GTX 1060 Windforce OC D5X, MSI Radeon RX 580 Armour MK2 8G OC

WINNER:
GIGABYTE GEFORCE GTX 1060 WINDFORCE OC D5X



BEST PERFORMANCE VIDEO CARD OF 2018
FINALISTS:
Asus Dual GeForce RTX 2070 OC 8GB, Asus ROG Strix RTX 2080 Ti O11G Gaming, Gigabyte Aorus GeForce RTX 2080 Ti Extreme 11GB, MSI GeForce RTX 2070 Ventus 8GB, MSI GeForce RTX 2080 Ti Gaming X Trio 11GB

WINNER:
ASUS ROG STRIX RTX 2080TI O11G GAMING

BEST GPU COMPANY OF 2018
FINALISTS:
AMD, Nvidia

WINNER:
NVIDIA

BEST VALUE CPU OF 2018
FINALISTS:
AMD Ryzen 5 2600, AMD Ryzen 5 2400G APU, Intel Core i3-8300, Intel Core i5-8500

WINNER:
INTEL CORE I5-8500

HIGHLY COMMENDED:
AMD RYZEN 5 2600

BEST PERFORMANCE CPU OF 2018
FINALISTS:
Intel Core i7-8700K, Intel Core i9-9900K, AMD Ryzen Threadripper 2950X, AMD Ryzen 7 2700X

WINNER:
INTEL CORE I9-9900K

It began with an intensive shortlisting process, creating finalists for the best-of-the-best gear that was released through 2018. Then, we opened up the voting for the Awards to the Australian public – you – the real experts with the most valued opinions. You had your say, and at the end of the voting period the winners across all the important PC categories rose to the top, and now it's finally time to reveal the champions.

On a glorious March night in Sydney, the big moment came and throughout the night the winners were announced and trophies claimed. And, there was much joy as the hard work and innovation of the winners was rewarded with an Australian PC Award, as voted by you. Every company that was a finalist has every right to feel proud, too. It's a tough industry with fierce competition that endlessly creates better and better products, so to every company that was represented we say congratulations – whether you took a trophy home or not.

Award highlights included Corsair taking home the highly-coveted Gold Award for Best Company, winning out over many other big-name PC brands

BEST CPU COMPANY OF 2018
FINALISTS:
AMD, Intel

WINNER: INTEL

BEST SATA SSD OF 2018
FINALISTS:
HyperX Fury RGB SSD, Samsung 860 Evo, Samsung 860 Pro, Seagate Barracuda SSD

WINNER:
SAMSUNG 860 PRO

BEST NVME SSD OF 2018
FINALISTS:
Crucial P1, Intel Optane 800P, Intel SSD 660P, Samsung 970 Evo, Samsung 970 Pro, WD Black NVMe SSD

WINNER:
SAMSUNG 970 PRO

BEST HARD DRIVE COMPANY OF 2018
FINALISTS:
Seagate, Toshiba, WD

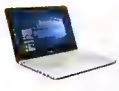
WINNER:
SEAGATE

BEST HOME NAS OF 2018
FINALISTS:
Asustor AS3202, Asustor AS3204T, Asustor AS4004T, QNAP HS-453DX, QNAP TS-251B, Synology DiskStation DS218+

WINNER:
SYNOLOGY DISKSTATION DS218+

BEST SOHO NAS OF 2018
FINALISTS:
QNAP TS-453Be, QNAP TVS-951X, Synology DiskStation DS1618+, Synology DiskStation DS1819+

WINNER:
SYNOLOGY DISKSTATION DS 1819+



BEST VALUE LAPTOP OR 2-IN-1 OF 2018
FINALISTS:
Acer Spin 5, Asus VivoBook Pro 17, HP 250 G6, Huawei Matebook X Pro, Kogan Atlas C300

WINNER:
ASUS VIVOBOOK PRO 17

BEST PREMIUM LAPTOP OR 2-IN-1 OF 2018
FINALISTS:
Apple MacBook Pro 15, Asus ZenBook Pro 15, Dell XPS 13, Microsoft Surface Laptop 2, Microsoft Surface Pro 6, Razer Blade Stealth

WINNER:
RAZER BLADE STEALTH

and demonstrating just how well-respected the memory, case, PC and peripherals maker is in the Australian PC scene.

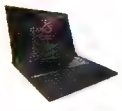
And speaking of the local scene, enthusiast-friendly Aussie retailer PC Case Gear managed to take home not one by two awards last night, coming away with the trophies for both the Best Desktop PC Builder and Best Reseller (Online) categories.

AND THE WINNERS ARE...

Corsair and PC Case Gear weren't the only winners, of course, with the likes of Asus, Razer, Samsung, Synology and Logitech also racking up awards of their own.

And remember: you made this happen. But if your favourite thing that you voted for didn't get a gong this year that's OK – because the Australian PC Awards is an annual staple of the PC scene, so this time next year we shall call upon you, the Australian public, to once again vote – because ultimately it's your opinion that matters most.

THE WINNERS



BEST GAMING LAPTOP OF 2018
FINALISTS:
Acer Helios 300, Aorus X9DT, Asus ROG Zephyrus S GX531GS, Dell XPS 15 2-in-1, Gigabyte Aero 15X, MSI GS65 Stealth Thin, Razer Blade 15

WINNER:
ASUS ROG ZEPHYRUS S GX531GS

BEST DESKTOP PC BUILDER OF 2018
FINALISTS:
Acer, Alienware, Asus, Aus PC Market, Corsair, Dell, HP, Lenovo, MSI, MSY, Mwave, PC Case Gear, PLE, Scorptec, Umart

WINNER:
PC CASE GEAR

BEST MEMORY COMPANY OF 2018
FINALISTS:
Adata, Corsair, Crucial Ballistix, G.Skill, Geil, Kingston, Team T-Force

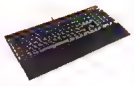
WINNER:
CORSAIR

BEST COOLING PRODUCT OF 2018
FINALISTS:
Cooler Master MasterAir MA410M, Cooler Master MasterLiquid ML240R RGB, Corsair Hydro Series H115i RGB Platinum 280mm, Deepcool Gamer Storm Castle 240 RGB, Thermaltake Pacific M360 Plus, Thermaltake Riing Trio LED RGB Fan

WINNER:
CORSAIR HYDRO H115I RGB PLATINUM 280MM

BEST MONITOR OF 2018
FINALISTS:
Acer Predator X27, Acer Predator X34P, AOC AG273QCG, AOC AG322QC4, AOC AG352UCG6, AOC C27G1, Asus ProArt PA27AC, Asus ROG Swift PG27UQ, LG 27UK850-W, Philips 436M6VBPAB, Samsung CJ89, Samsung Thunderbolt 3 Curved QLED, ViewSonic VP3881

WINNER:
ASUS ROG SWIFT PG27UQ



BEST KEYBOARD OF 2018
FINALISTS:
Corsair K70 MK.2, HyperX Alloy Elite RGB, Logitech G613, Razer Huntsman Elite, Thermaltake Tt Premium X1 RGB

WINNER:
CORSAIR K70 MK.2

BEST MOUSE OF 2018
FINALISTS:
Corsair Dark Core RGB SE, Logitech G203 Prodigy, Razer Mamba Elite, SteelSeries Sensei 310, Thermaltake Tt eSports Iris Optical RGB

WINNER:
RAZER MAMBA ELITE

HIGHLY COMMENDED:
CORSAIR DARK CORE RGB SE

BEST GAMING HEADPHONES OF 2018
FINALISTS:
Corsair HS70, Logitech G Pro Gaming Headset, Razer Nari Ultimate, SteelSeries Arctis Pro, Thermaltake Tt eSports Shock Pro 7.1 RGB, Turtle Beach Elite Pro Tournament

WINNER:
LOGITECH G PRO GAMING HEADSET

BEST PC CASE OF 2018
FINALISTS:
Cooler Master MasterCase SL600M, Corsair Obsidian Series 500D RGB SE, Fractal Design Define S2, Lian-Li O11 Air, NZXT H200i, Phanteks Enthoo Evolv X, Thermaltake View 37 ARGB Edition

WINNER:
CORSAIR OBSIDIAN 500D RGB SE

BEST ROUTER OF 2018
FINALISTS:
Asus ROG Rapture GT-AC5300, Google Wifi, Draytek Vigor2762Vac, Linksys Velop (Dual-Band), Netgear Orbi RBK23, Synology MR2200ac, TP-Link Archer C5400X, TP-Link Deco M5

WINNER:
ASUS ROG RAPTURE GT-AC5300

BEST ONLINE RESELLER OF 2018
FINALISTS:
Aus PC Market, Centre Com, CPL, Harris Technology, MSY, Mwave, PC Case Gear, PLE, Scorptec, Umart

WINNER:
PC CASE GEAR

BEST RETAIL RESELLER OF 2018
FINALISTS:
Adelong Electronics, ARC Computers, Centre Com, Harvey Norman, JB Hi-Fi, JW Computers, Mwave, Officeworks, PLE

WINNER:
JB HI-FI

GOLD AWARD - BEST COMPANY OF 2018
FINALISTS:
AMD, Asus, Razer, Thermaltake, Synology, Qnap, Samsung, Corsair, AOC, Acer, TP-Link, MSI, Logitech

WINNER:
CORSAIR
HIGHLY COMMENDED:
ASUS
HIGHLY COMMENDED:
AMD

WITH THANKS OUR SPONSORS
Acer, AOC, Asus, Corsair, QNAP, Razer, Samsung, Synology, Thermaltake, and TP-link

apc RECOMMENDS

ULTRABOOK

$3,239 AS TESTED | WWW.DELL.COM.AU

Dell XPS 13 (9380)

Is the latest XPS 13 a refined upgrade, or did Dell just take its foot off the throttle?

Dell's XPS 13 has been at the top of our best value ultrabook list for the past few years, and Dell hasn't changed this winning formula too much with its new XPS 13 (9380). The most stark contrast from the 2018 XPS 13 is the addition of a Frost White edition that flaunts a woven carbon fibre keyboard surround, but you'll also probably notice that a pinhole webcam now sits at the top of the InfinityEdge display. These minor updates are great additions to a laptop that has already got so much right, but with newcomers like Huawei driving down price expectations and select Razer Blade Stealth models introducing dedicated entry-level gaming GPUs, the XPS 13 now has more ultrabook competition than ever before.

Depending on your needs, you can configure the XPS 13 with either an Intel Core i5-8265U or a Core i7-8565U CPU, 8 or 16GB of RAM, and one of the three sizes of PCIe-connected SSD storage (256GB, 512GB and 1TB). These units range in price from the one Core i5 model at $2,299 to $3,599 for the top of the line Core i7 model that comes with a 16GB RAM allocation and a 1TB NVMe SSD. Even at full RRP, the 9380 isn't unreasonable, but Dell often has discounts of 10% or more on its own store.

The unit we tested came with a Core i7-8565U CPU that offers a pretty solid 1.2GHz bump in the maximum clock speed from last year's similar i7-8550U. This translated into a performance boost of between 5 to 15% on raw processing tasks like single and multi-core Cinebench R15 and Geekbench 4 benchmarks. While this didn't make a massive difference to the device's PCMark 8 scores, PCMark 10 tests showed a 26.1% boost for general work tasks.

This additional performance, however, came at a cost to the CPU's thermals. We were able to get all cores on the CPU to readily spike to 100°C (possibly higher, since the scale maxes out here). This didn't cause any detectable throttling, but temperatures this high are likely to negatively affect the lifespan of the device.

The GPU on the Core i7-8565U is the same as the older i7-8550U CPU, so there's not much of a difference in graphical performance from earlier models. As we said earlier, the Huawei Matebook X Pro and the Razer Blade Stealth (2019) both sport dedicated Nvidia GeForce MX150 GPUs, which seriously bolsters graphical performance. In Cinebench R15's OpenGL GPU performance test we noted a 47.88% bump for laptops using the MX150 vs Intel integrated graphics, but we saw improvements as high as 180% on some 3DMark graphics tests. The MX150 is more than enough for lighter games like *Rocket League* and can even manage more demanding 2018 games on 720p/Low graphical settings at frame rates higher than 30fps, so the Dell XPS 13 has been clearly outclassed here.

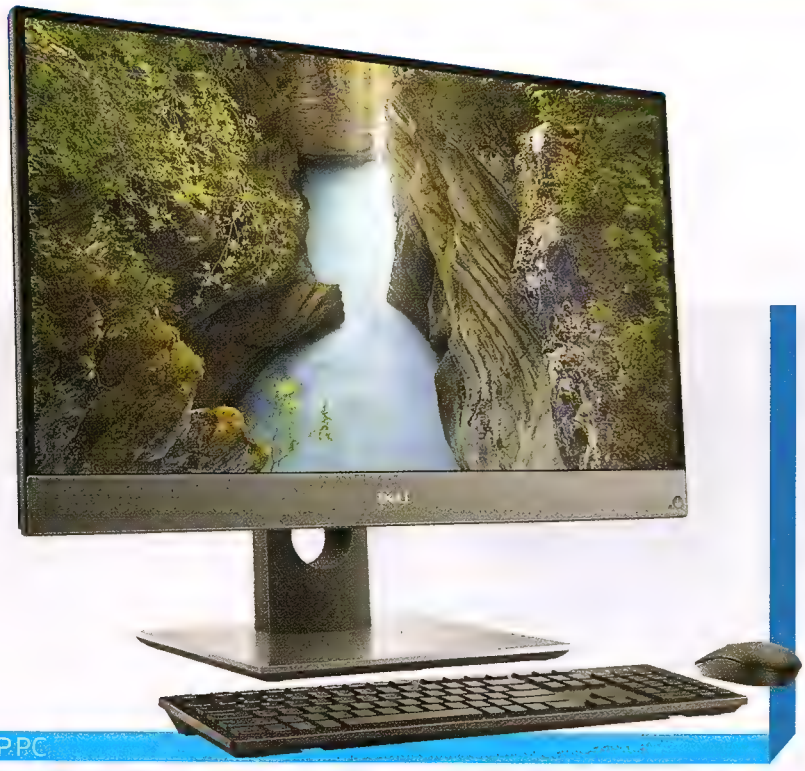
The 52Wh lithium-ion battery is the same capacity as last year, but our test device's higher-res 4K screen reduced the movie playback lifespan by 37% versus the 1080p 2018 model, for a total runtime of 4 hours and 31 minutes. While the XPS 13 is no longer a slam dunk, then, it's still great value as you do tend to get a bigger SSD or a higher screen res for less than the competition. ■

Joel Burgess

	PCMARK 8 - HOME (SCORE)	CINEBENCH R15 - CPU (MULTI-THREADED)	PCMARK 10 - EXPRESS (SCORE)	3DMARK FIRE STRIKE (SCORE)	BATTERY LIFE - 1080P VIDEO PLAYBACK (H:MIN)	PEAK CPU TEMPERATURE (°C)	CRYSTALDISKMARK READ/WRITE (MB/S)
DELL XPS 13 (9380)	3078	640	4139	1,179	4:31	100	2,685/1,431
RAZER BLADE STEALTH (2019)	3820	702	4,415	3,341	7:11	94	2,723/1,037
DELL XPS 13 (9370)	3261	618	3,283	1,181	7:12	N/T	2,228/459
HUAWEI MATEBOOK X PRO	3448	518	3,940	2,595	7:23	98	3,299/1,906
RAZER BLADE STEALTH 13 (2018)	3279	476	4,021	22,668	7:35	99	2,981/1,182

Verdict

There's still a lot to like about Dell's 2019 XPS 13, but it's not the must-have ultrabook it once was.



DESKTOP PC

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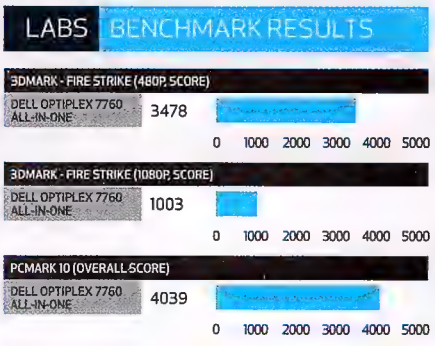
LABS BENCHMARK RESULTS


3DMARK - FIRE STRIKE (4800 SCORE)
DELL OPTIPLEX 7760 ALL-IN-ONE
3478
0 1000 2000 3000 4000 5000
3DMARK - FIRE STRIKE (1080P SCORE)
DELL OPTIPLEX 7760 ALL-IN-ONE
1003
0 1000 2000 3000 4000 5000
PCMARK 10 (OVERALL SCORE)
DELL OPTIPLEX 7760 ALL-IN-ONE
4039
0 1000 2000 3000 4000 5000

Dell OptiPlex 7760 All-in-One

A servicable all-in-one PC for the workplace or school.

Dell's new OptiPlex 7760 all-in-one PC is boring, but that's a good thing. You unbox it, plug in a power cord, turn it on and Windows appears. Now you can do your work. There's no fully customisable 16 million colours of LEDs on the case and no insane 3D gaming performance that'll melt your eyeballs. The OptiPlex 7760 is just a normal PC that gets out of the way to let you do normal computer stuff.

The target market for the OptiPlex 7760 is workplaces or schools needing hundreds of these things to place on people's desks to get their work done, or in a lab or library so students can get their work done. The all-in-one design theoretically means there's less crap cluttering up the working area. Once upon a time, an all-in-one PC meant 'slow and unupgradable', but in 2019 that's no longer the case.

Inside the OptiPlex 7760 is your choice of 8th-generation Intel CPUs, NVMe PCIe SSDs in various sizes and up to 32GB of DDR4-2666 RAM. Unless you need hardcore 3D graphics, the all-in-one form factor won't slow you down like it used to. As usual with Dell, there's a plethora of configuration options so you can usually get what you need directly from the factory.

The OptiPlex 7760 also comes with a DisplayPort and HDMI port to plug in a second monitor, gigabit Ethernet and four USB 3.1 ports on the rear. On the side are a single USB 3.1 Type-C port, one normal USB 3.1 port, SD card reader and headphone socket. Good thinking from Dell to place those ports on the side, rather than the rear of the case. This makes it so much easier to connect those devices than on other all-in-one PCs that only place ports on the rear.

Dell's gained a solid reputation for its high quality UltraSharp monitors, but that same quality unfortunately doesn't extend to the OptiPlex 7760. The default display is a 27-inch 1080p panel, which is fine for office use, but isn't in the same league as most UltraSharp displays. There's a 4K UHD option, but no 1440p – the ideal resolution for a 27-inch display. It would have been great if Dell took the panel from the U2719D and made it an option for this machine.

If you're looking at the picture of the OptiPlex 7760 and wondering where they stashed the webcam – it pops up from inside the case! Push down on the camera module on the top of the display and it slides up, containing a webcam and an IR camera suitable for face login using Windows Hello. It's a nifty solution to keep the slim bezels, but also tuck the camera away when it's not in use.

Those in the market for a no-frills all-in-one PC that's backed by Dell's support and warranty – and with loads of customisation options to get exactly what you need – won't be disappointed with the OptiPlex 7760. The only way this all-in-one could be better is if Dell improved the selection of displays to go with it. ■ **Anthony Agius**

Verdict

Gets the job done with no frills, and offers Dell's superior support and plenty of customisation options.

apc HOT PRODUCT

GRAPHICS CARD

$379 | WWW.ASUS.COM/AU

Asus GeForce GTX 1660 Phoenix

Genuinely affordable Turing is here.

Nvidia is on a Turing roll, and the new GTX 1660 is the most affordable Turing card yet. Does it have what it takes to shake up the mid-range market that's been largely stagnant for the last couple of years?

The GTX 1660 skips all of the high end FPS draining RTX features and is designed for efficient 1080p gaming at a decent price, whilst remaining cool and power thrifty. We're testing the Asus GTX 1660 Phoenix. It's a value-oriented model and a great example of a card that delivers the all-important underlying GPU features and inherent performance. Budget graphics card buyers really don't need expensive custom PCBs and extravagant cooling solutions. Keeping it simple at this end of the market is undoubtedly the best approach for GPU makers and customers alike.

The GTX 1660 is powered by the TU116 GPU. It's a cut down version of the one found in the 1660 Ti. There's 1,408 Turing CUDA cores paired with 6GB of 8Gbps GDDR5 memory. It's a step down compared to the faster GDDR6 from the 1660 Ti. It gets a slight GPU clock boost however. A 120w TDP is great to see. A single eight-pin power connector keeps it compatible with budget power supplies.

This Phoenix card we're reviewing has a simple design. A single fan is easily capable of keeping the TU116 GPU cool. It's a touch louder than a high-end cooler like you'd get with an Asus Strix card, but it's far from annoying. It comes with a single DP, HDMI and DVI-D connectors.

What matters is how it performs. We've introduced *Metro: Exodus* to our benchmark suite, and gee, it's a tough one! Still, the 1660 is perfectly playable at high, but not maximum settings. It's a great 1080p choice, though 1440p gaming will require dialling back on some settings. The 1660 is a good 15%+ faster than the GTX 1060 and of course it smokes something like the GTX 960, making it a solid upgrade for someone coming from a card that's perhaps a few years old.

The Asus Phoenix cooler isn't a behemoth, so we expected it to run a bit warmer than a premium custom card. We saw peak temperatures in the upper 70's, which is good enough to allow Nvidia's GPU boost to reach 1,850MHz+ and stay there through an extended gaming session.

The Asus GTX 1660 Phoenix is a perfect example of the form an affordable graphics card should take. Price/performance is the number one criteria. It's a simple card, eschewing unnecessary extras like RGB lighting or a complicated multi-phase PCB. If we're to be critical, it would be nice to see GTX 1660 pricing a few dollars cheaper. This is something we've said with all Turing cards though. The Asus Phoenix is one of the cheapest, so this isn't an Asus fault. The 1660 isn't quite the mid-range destroyer we'd like to see, but if you're looking for a capable and affordable gaming card right now, this Asus Phoenix in particular is a good choice. ■

Chris Szewczyk

Verdict

Asus' Phoenix GTX 1660 is a simple, affordable and highly capable mainstream 1080p graphics card.

	GHOST RECON WILDLANDS (VERY HIGH PRESET, AVG FPS)		METRO: EXODUS (ULTRA PRESET, AVG FPS)		SHADOW OF WAR (ULTRA PRESET, AVG FPS)		SHADOW OF THE TOMB RAIDER (AVG FPS)	
	1080P	1440P	1080P	1440P	1080P	1440P	1080P	1440P
NVIDIA GEFORCE GTX 1070 TI	85.0	64.1	55.4	41.9	86	60	82	55
NVIDIA GEFORCE GTX 1060	60.7	44.1	34.7	26.3	56	38	54	35
NVIDIA GEFORCE GTX 1050 TI	39.5	27.7	19.5	14.9	43	28	31	20
AMD RADEON RX 590	64.7	48.1	41.8	33.4	82	54	66	44
AMD RADEON VEGA 56	75.1	57.0	57.7	44.7	85	57	81	55
NVIDIA GEFORCE RTX 2060	91.4	67.6	55.3	42.5	95	66	88	58
MSI GEFORCE GTX 1660 TI GAMING X	82.3	60.8	41.3	31.5	82	56	80	53
ASUS GEFORCE GTX 1660 PHOENIX	69.6	50.3	39.6	30.0	66	47	66	44

$499 | WWW.DLINK.COM.AU

D-Link D-Fend DIR-2680

A secure, family-friendly AC2600 router.

Last year, Symantec's funky-looking Norton Core router impressed us by offering decent Wi-Fi married with network security. However, it's being phased out, so D-Link's rice-cooker-looking rival comes at a good time for those seeking a security-focused family oriented router.

The D-Fend represents a three-way collaboration: it's a D-Link product running McAfee's Secure Home Platform using Intel's System-on-Chip (SoC) hardware. It secures everything on your network (especially vulnerable smart devices) and automatically isolates threats.

D-Link's Wi-Fi app walks you through basic name-and-password set-up before prompting you to download a separate D-Fend app. The former offers few options beyond combining (or separating) the 2.4GHz and 5GHz network bands into one network, setting-up a guest network, implementing access schedules and integrating Google Assistant and Alexa.

The D-Fend app makes securing your network simple, but isn't quite seamless; when it said we were secure, it confusingly displayed a 'two-thirds complete' pictogram, for example. Notifications appear whenever a new device connects to the network, and you're invited to rename and confirm the type of device when this happens. Unfortunately, these useful labels aren't then shared with the Wi-Fi app (or browser-accessed firmware settings) which still list all client devices by MAC address.

The parental controls allow you to set profiles for different children and assign them to different devices. Each can have a different access schedule while content can be automatically blocked according to their age group. We were slightly annoyed that the broad settings blocked apps like Stan and Netflix by default, but other categories were more useful. While many of the obvious high-profile sites were correctly blocked for each content category, it's worth remembering that no blacklist of dubious sites will ever be complete – especially to the dedicated teen.

In terms of performance, it never managed to deliver peak Wi-Fi performance: our 115Mbps internet connection was tested and verified by the D-Link router itself but, when beamed to our test iPad Pro, only managed 100Mbps up close. However, it did only drop to 90Mbps one floor up and still managed an impressive 64Mbps two-floors up, which means there was no urgent need for a range extender.

D-Fend can also send invites to network clients to download McAfee LiveSafe Internet Security (where compatible). The resulting subscriptions last for 2 years and are worth $300. The integrated McAfee Secure Home platform comes with a 5-year license which we're told is worth $600.

It's not cheap for an AC2600 router, but there's value on offer. While parental controls and built-in security are becoming common features of the latest AX routers, they're not as well-integrated. With Norton Core going end-of-life, the D-Fend is a worthy successor and its enhanced security doesn't come with any significant performance limitations. ■ **Nick Ross**

Verdict

It's expensive, but represents good value thanks to integrated security with negligible performance impact.

★★★★☆

INKJET PRINTER

$799 | WWW.EPSON.COM.AU

Epson Expression Premium ET-7700

A five-colour inkjet multi-function with cheap running costs.

For years, printer manufacturers have employed the Gillette business model. Sell the handle (ie. the printer) cheap or at a loss to lure you in, then sell the blades (ie. the ink) at a premium for years after. Epson's decided time's up on that business model with their latest range of EcoTank printers.

The Epson Expression Premium ET-7700 has an RRP of $799 and a full set of ink will only set you back $121.95. For most printers, the opposite is true, and an ink cartridge capable of much less than 9,000 pages sells for $60 to $70 each.

However, while this new pricing model may sound great at first glance, if you're not a heavy printer it could end up costing you more in the long run due to the high up-front price of the printer.

Setup is a piece of cake, as Epson's driver package detects the printer on the network immediately and smoothly installs all the bits required to make this printer print and the scanner scan. Even if you're a networking novice, you won't have any trouble getting the ET-7700 going. The bad old days of printers being a headache to install are thinkfully long gone.

Feature wise, the ET-7700 does what you expect a multi-function printer in 2019 will do. It's got Wi-Fi and Ethernet, supports printing from mobile devices (Google Cloud Print & Apple AirPrint), has an A4 flatbed scanner that'll also photocopy without the need of a computer, and print from a USB stick or SD card without having to use a computer too. There's even a nifty tiered paper tray so you can keep your photo paper and document paper separate, but ready to go without having to swap.

When using photo paper the ET-7700 can make borderless photos that look almost as good as those from a proper photo printing machine at places like Officeworks or Kmart. It's probably not something you want to do often, as even with the low price of the EcoTank ink, it's more expensive per print than a photo lab.

Scanning and copying work a treat thanks to the high resolution 1,200 x 2,400 DPI flatbed scanner. It's great being able to just walk up to the printer, place a document on the scanning plate, press scan and have appeared immediately in the cloud (Box, Dropbox, Evernote and Google Drive) using Epson Connect. Epson Connect also has a weird feature where you can email your printer (Epson gives a unique email address to each) and whatever attachment is sent is printed off.

Epson has some of the best inkjet technology on the market and it shows here with the ET-7700. Quality is high in both photo and document printing, the feature set is complete and is easy to use, but you really need to do your sums to make sure the EcoTank system is cost effective for you, particularly if you're not against using third party consumables, or compared to a colour laser printer if you aren't printing photos.

Anthony Agius

Verdict

High volume users will love how cheap the ET-7700 is to run, despite the higher upfront cost.

"The pièce de résistance is the quad-array camera. Huawei says it took two years to design the new 40-megapixel 'Super Spectrum Sensor' plus another to figure out how to build it."

apc HOT PRODUCT

SMARTPHONE

$1,599 | WWW.HUAWEI.COM/AU

Huawei P30 Pro

Superlative technology makes it feel like more than a phone.

Last issue we raved about Samsung's new S10+ smartphone – a preposterously-priced proposition with some jaw-dropping features. Now, here's Huawei's new flagship to make it feel old.

The phone is dripping with impressive-sounding technology. Like the S10+ there's an in-screen, ultrasonic fingerprint reader. It worked slightly better than Samsung's but still wasn't totally reliable. We preferred the quick and accurate face-recognition system which can be used to unlock both the phone and individual apps.

The 2K, OLED, HDR screen is bright with vibrant colours. It's great for multimedia consumption but doesn't quite offer the punchiness of the S10+ with it's in-your-face colours and higher resolution.

Under the bonnet is a 2.6GHz Octo-core CPU with two "AI" processors plus 8GB RAM. These allowed the Android 9.0 operating system to fly along with virtually no lag when opening apps. The Mali-G76 GPU took games in its stride.

There's no earpiece-speaker for the phone. Instead, sound resonates through the "acoustic display". This partly saves space but also helps produce loud and punchy audio. Unfortunately, there's no headphone jack: modest, bundled earbuds attach to the USB-C 3.1 port.

However, the pièce de résistance is the quad-array camera. Huawei says it took two years to design the new 40-megapixel "Super Spectrum Sensor" plus another to figure out how to build it. It eschews the usual RGB technology for RYB which helps with low-light scenes – this gives it an ISO rating of over 400,000! An 8MP 'Periscope' camera offers 5x optical zoom by moving lenses vertically within the body and using a prism to see out the back. The third camera is an ultra-wide-angle (16mm equivalent) with special algorithms to remove fishbowl distortion. The fourth is a special 'Time-of-Flight' camera which measures the distance between objects for more accurate focusing and depth-of-field effects. The selfie camera has a 32-megapixel resolution.

All optics are provided by Leica. There's both AI and optical image stabilisation, and a special cooling system reduces heat and subsequent image noise.

In testing, the exposure was almost universally excellent with crisp, vibrant (yet accurate) colours. Low-light performance reached another level: in a pitch-black field it managed to simultaneously capture green grass and pin-sharp stars in a quick, hand-held shot – an extraordinary technical feat. It also captured usable images at 50x digital zoom. The performance stretches to video recording, too, with superb stabilisation and minimal noise.

The large 4,200mAh battery didn't quite match its two-day promise but we're told it will improve once the AI learns our behaviour. It can rapidly charge to 70% in 30 minutes (wired) while wireless charging has been sped up. It can also wirelessly charge other devices.

Other features include IP-68 waterproofing (1.5m immersion for 30 minutes). Augmented-reality and gesture-related features walk the path between technical showcases and gimmickry Huawei includes a thin, clear, grip-friendly, silicone case so you can see the classy-white (or blue) chassis when it's protected.

At $1,599 it's very expensive (the regular P30 costs $500 less but loses many features). Nonetheless, we can't fault it and in a world of super-expensive phones, it's arguably the new king.

Nick Ross

Verdict

Even better than it's similarly-expensive rivals.

★★★★★

MECHANICAL KEYBOARD

$149 | WWW.RAZER.COM

Razer BlackWidow Lite

The gaming company focuses on office productivity – with mixed results.

Razer pretty much kickstarted the current mechanical keyboard craze with its highly gaming-focused BlackWidow keyboard, but this new Lite iteration looks beyond the frags by making a claim to office dominance – as well as the usual deathmatch variety. And while it does succeed on many counts, a handful of patently bizarre design and production choices leaves me still fond of the keyboard, but also shaking my head.

The BlackWidow Lite is trimmed down to offer the bare minimum. It's a ten-keyless design with an open chassis – it not only looks the business, without any excessive and aggressive gamer styling, but makes it a breeze to keep free of dust and crumbs. If you frequently eat at your desk – either during the work day or while relaxing at home, that's pretty handy. The keyboard is lit, too, only not by the now ubiquitous garishly coloured RGBs of the gaming space, but rather clean, white LEDs. The smaller form factor is also great for those of us – like me – whose desks tend toward the cluttered.

> "There's a definitive bump and actuation point, with a solid amount of travel, without the audible 'click' click of most mechanical keyboards."

The mechanical switches in the BlackWidow Lite are Razer's own design, and of the company's 'orange' variety, which delivers a similar mix of quiet performance and tactile feedback as Cherry's Brown switches. There's a definitive bump and actuation point, with a solid amount of travel, without the audible 'click' of most mechanical keyboards. Generally speaking, I vastly prefer proper Cherry switches, but after some trial and error, Razer's efforts have come a long way, and typing on the BlackWidow Lite feels accurate and responsive, without annoying the rest of the office. And if you want to get even quieter, the keyboard comes with special rubber O-rings... but that's when things start getting a little kludgey.

Razer's marketing collateral very strongly implies that the Orange switches and the O-rings come as a package, which is a bit of a fib. In reality, the O-rings come in a separate package, and to install them you need to pull off each key one-by-one, roll the O-ring over each keycap's plunger mount, and then replace it on the keyboard. There's not even anything telling you exactly how to do all this, so for anyone who's never pulled a keyboard apart before, it may well be a little daunting. The O-rings also dampen the brightness of the LEDs in the switches, and since they're yellow, they leave a yellow cast over about a third of each character on the key.

That said, they certainly do the job however, handily damping down the sound that the switches make – which is already very quiet – and cutting out a lot of the clack you get from the keyboard chassis.

Still, having to DIY a product that costs $149 is bit of an ask, even if it does deliver.

David Hollingworth

Verdict

Will reduce even the fiercest typist's noise to tolerable near-silence.

apc RECOMMENDS

BLUETOOTH HEADPHONES

$499 | WWW.MICROSOFT.COM/EN-AU

Microsoft Surface Headphones

An audaciously competent entry in the mid-range NC headphones market.

Microsoft's hardware business is playing in a new category with the Surface Headphones. It should be no surprise – the company has been heavily involved with the development of digital audio for decades. Perhaps the advent of voice assistance – which these support (via Cortana, Siri and Google Assistant) – was the impetus to get these to market. Whatever the reason, Microsoft, as it does, has come in with an extremely well-designed and engineered device that sits comfortably alongside the market leaders in this space.

Comparing these to the Bose QC35 II and Sony WH-1000XM3 is the order of business here. They are all priced around the same level, offer very good active noise cancelling and better than average audio quality. Music and voice playback amongst the three is virtually equal, though I'd rank the Sony's as just a little better, and the Bose and Surface are more or less the same. And it's a good same – a very clean and natural sound without artificial EQ hampering its easy listening. That's particularly important if you're on a long flight.

The Surface headphones do bring unique large physical dials to the party. Essentially the entire outer edge of the cup is a rotating control. One side for volume, the other for adjusting noise-cancelling levels – which include turning them beyond neutral to actually amplify external sounds. These are more than neat tricks; it's clever design that is almost reason-enough to pick these.

The active noise cancelling (ANC) is likewise extremely competent. They don't have that odd "air pressure" feel you get with Bose's QC35 IIs, and which Sony has almost engineered out with its Mk.3 version of the WH-1000s. Alas, there's only sufficient battery for 12-15 hours of ANC. That's likely going to be a deal breaker for travellers when you consider the Sony's can run for a remarkable 30 hours, and the Bose for around 20. They all have quick charging, and can run as pure headphones (no ANC) via the 3.5mm cable.

Bluetooth performance is fine, and pairing was quick and stable on Android devices. Oddly, it refused to pair with a 2018 MacBook Pro. I'm not sure where the blame lies with that, but it's something I'd expect to be solved with a firmware update or driver-side, if it's the Mac causing issues.

Comfort is superb. The large soft cushions cover your ears nicely – and even my oversized ears were accommodated well, where the shallower Sony set's cups tends to touch my ear with the speaker surface.

Being a somewhat conservative company, the aesthetics of the Microsoft Surface Headphones are the antithesis of loud design. You will invisibly blend in with your workmates wearing these in the office, and if you drop the occasional "Hey Cortana, what's our share price today" no one will suspect you're actually listening to something you enjoy.

The only small downside is the cups here only rotate outward when off the ears and hanging around your collar, which means the hard plastic side can annoyingly bang against your upper chest as you walk.

These are a mighty entry into the ANC headphones market. As long as you're the type that buys headphones based on performance instead of branding, and, if you can handle the limited battery life, they're an excellent choice.

■ Ben Mansill

Verdict

Very good audio, comfort and features, but long haul fliers won't like the shorter battery life.

★★★★½

WIRELESS GAMING MOUSE

$90 | WWW.CORSAIR.COM

Corsair Harpoon RGB Wireless

Spearing the competition in the hunt for best wireless gaming mouse.

Wireless gaming mice are often unreasonably expensive. At the top end of town, you can expect to pay up to $200 for the most 'premium' options and our most recent favourite, Logitech's G Pro Wireless Gaming Mouse, will set you back a cool $249. With its new Harpoon RGB Wireless, however, Corsair's really showed up the competition and neatly demonstrated that, at just $99, a fantastic wireless optical gaming mouse doesn't need to come at an outlandish price. And then it's gone beyond that by also integrating a dedicated Bluetooth mode.

The Harpoon is largely ready to go out of the box, with five preset sensitivity settings (up to the max of 10,000 dpi) which can be changed on the fly using a dedicated button behind the scroll wheel, which has a small LED that changes colour to indicate which you're on. There's a dedicated 2.4GHz wireless transmission mode that's paired with a small USB receiver, and uses Corsair's sub-1ms Slipstream wireless tech for communication. You can also use the Harpoon plugged in, with a 195cm-long braided USB cable. We honestly couldn't detect any difference in responsiveness or latency between going wired or wireless.

We really have zero complaints about the Harpoon RGB Wireless. It's got flawless wireless technology, a super-comfy design and a price that massively undercuts most of the competition. ■

Dan Gardiner

Verdict

Corsair's shown that premium wireless gaming mice don't need to cost a motza. Our new favourite.

★★★★★

GLASSES

$98, $150 INC. PRESCRIPTION | WWW.EXYRAEYEWEAR.COM.AU

Exyra Blue Light Filtering Glasses

Sick of seeing red or feeling blue?

There's plenty of research that points to the link between light exposure and the production of melatonin, a hormone that regulates our sleep patterns, but there are also a number of studies that show blue light to be particularly disruptive to our circadian rhythms.

Sadly this short wavelength light is particularly prevalent in the screens of the gadgets we like to use before bed and it's not always possible (or desirable) to implement 'red shift' screen lighting effects on all your devices. Exyra was an Aussie Indiegogo campaign that received 376% of its funding goal in March 2017 for blue light filtering glasses that combat the sleep inhibition effects of blue light. While the glasses' filtering effects are subtle, we tested the reflection of the lenses using an LED lamp on an energising blue-white light setting and could clearly see a difference in the amount of light reflected against regular lenses. Despite cutting out a lot of the high energy blue light, the most disruptive light wavelengths sit close to the non-visible ultraviolet light, so the lenses don't distort screen colour in any significant way. You can get the glasses fitted with your own prescription. All styles come with 100% UV protection and, in addition to sleep benefits, the glasses are claimed to reduce eye strain during extended screen sessions.

The active effects and the science behind them suggest that Exyra glasses could make a big difference. ■

Joel Burgess

Verdict

All the benefits of blue light filtering with no negative impact on screen colours.

★★★★½

VERTICAL MOUSE

$169.95 | WWW.LOGITCH.COM

Logitech MX Vertical

The mouse that loves you back.

If you're like me, you've been using a mouse for two or three of decades and that can cause some seriously painful muscle ache that develops over time. For me, it manifests as a sharp pain in my right shoulder. This vertical mouse, however, eases the load on certain muscles and tendons simply by rotating your hand position to a vertical 'hand shake' orientation. Logitech claims a 10% reduction on muscular strain and, having used this for a month, that sounds about right – but that 10%, for me at least, was enough to almost banish the pains. So, I love this thing and it's going to get top marks.

I have massive respect for Logitech's designers and engineers, I've previously visited its R&D HQ and this device was created with the help of ergonomists. There would have been many iterations before production was locked in, so using this I feel like there's more science at play than just rotating your hand.

> "This vertical mouse eases the load on certain muscles and tendons simply by rotating your hand position to a vertical 'hand shake' orientation."

It's wireless (or cabled if you prefer) and comes with Logitech's standard teensy tiny USB dongle, which barely sticks out more than its plastic cap from the port. This 'Logitech Unifying Receiver' supports up to six compatible Logitech devices, and uses the 2.4GHz spectrum. Alternatively the MX Vertical can just use your computer's Bluetooth to work. A very healthy four months of charge is claimed, and a quick charge feature offers three hours of power after a minute of charging.

You will need to download the Logitech Options software to set more than the default two DPI levels (1000 and 1600), or customise any buttons. It's mature software and is available for Mac and PC. I found the need to immediately lower the DPI – it was unusual enough with the hand in this new position, so with quick DPI it was a bit much to adapt. So starting with a lower DPI is a good training mode. It works delightfully, too – just hold the top button and move the mouse left or right to raise or lower DPI. It adjusts in 50DPI increments. Maximum DPI is 4000, which, while well short of gamer mouse levels of precision, is absolutely enough for any use.

In the hand it feels very natural – after you retrain decades of normal mouse conditioning. Forward, back, the wheel and left and right all fall naturally and the light weight is very nice to use. There's a subtle rubberised coating on the thumb side and where your little finger falls. It also works well if you're the type that likes to lift and flick the mouse to reach far corners of your screen.

I'm not going back. This is my new permanent work mouse. Once you acclimatise to the new hand position it's as natural as any other mouse. In fact, the only important retraining I needed to do was allow for the extra height – for the first few days I was knocking it over as I swept my hand across the desk to reach for something. ■

Ben Mansill

Verdict

For those suffering mouse pain this is a big help, and, it's just nice to use.

★★★★★

RTX to go: Nvidia 20-series gaming laptop group test

Nvidia wants to show you the light with its new 20-series cards, but do they offer enough to entice you across to the novel paradigm of ray-traced laptop gaming? Joel Burgess hits the Labs to find out.

Nvidia's new RTX cards have finally made their way to the gaming laptop space, and there's no better way to welcome the new generation than with a gladiatorial battle where they're all pitted against one another. We have three units from each of the RTX 2060, 2070 and 2080 categories this year, giving us a good indication of the various graphical capabilities. Nvidia's big selling point for its 20-series graphics cards is the addition of a new game rendering technique called ray tracing and, while there are only a handful of tests you can run for ray tracing performance, we pegged a couple of the important ones here.

There's very little CPU diversity in the 2019 RTX offerings and every unit bar three came with a 15.6-inch 144Hz IPS display (Lenovo, Gigabyte and MSI's offerings had G-Sync, UHD or 17.3-inch panels, respectively). This means that the main variation we saw was in storage flavours, where many of the more forward-looking units were seeking to put in bigger PCIe-connected SSDs, with some even using faster NVMe drives and using them in RAID 0 configurations for 3000+MB/s read and write speeds.

While Nvidia's Max-Q is pushing the company towards better efficiencies and lower thermals, this was the laptop's second time using an Intel Core i7-8750H CPU (or even the third) and all of them were keen to push the limits of this chip, meaning CPU max temperatures were generally above 970°C.

In other words the competition was hot and there's plenty to dig into in this year's RTX laptop offerings.

"While there are only a handful of tests you can run for ray tracing performance we pegged a couple of the important ones here."

RTX 2080

apc RECOMMENDS

$4,898 | DELL.COM

Alienware m15

This Alienware's a little too familiar to be from another world.

Alienware has always had a reputation for offering high-end laptops with the most premium components and this year's m15 is no different. Like a poisonous creature, this laptop has a powdery red skin on the topside of the clamshell that bleeds into a soft black keyboard surround. The keyboard and trackpad (much like the well-worn angular chassis design) aren't revolutionary but they both feel nice enough to use to forget about that.

The 15.6-inch screen on this unit has a 144Hz refresh rate, lining up with most of the offerings in this year's roundup. The screen, however, does have a decidedly blue tinge to it and it's probably one of the worst in the roundup when it comes to cutting glare.

In general work and home tasks the CPU performed above average across all of our benchmarks, but this came at a thermal cost since it was one of only two units that we pegged with a maximum CPU temperature of 1000°C.

When it comes to gaming the Nvidia GeForce RTX 2080 performed as well as we were expecting, pushing out above 60fps averages on everything but *Ghost Recon Wildlands* on Ultra 1080p settings. The m15 did manage to top the group in ray tracing performance getting an average framerate of 50fps on *Metro: Exodus*. At 2 hours and 10 minutes, battery life wasn't stand out, but it was definitely one of the longer lasting devices. The one major benefit of the m15 over the Blade 15 from Razer is an additional 1TB of SSHD space for all the games you'll want to hit with this unit.

Verdict

A solid choice for a premium RTX laptop, but it is handicapped a little by a disappointing screen.

★★★★☆

72
techradar.
The home of technology
techradar.com

$5,099 | RAZER.COM

Razer Blade 15

Is the Blade 15 still a cut above the rest?

Razer's 2018 Blade 15 was one of the best gaming laptops of last year, and the subtle chassis tweaks and a hefty set of RTX GPU upgrades definitely don't hold it back. While, of course, the new graphics cards are the centrepiece of the update, the chassis has a re-honed squarer shape that will annoy anyone who likes the palm rest to be rounded. There's been an update to the RGB lighting, which minimises light bleed from underneath the chiclet keys and makes this flashy feature look far more sophisticated. This marries with some of the best feeling membrane keyboards available and a sleek, nicely sized trackpad.

While this unit was more than 20% behind the top units in Cinebench's Multi-threaded CPU benchmark and HWBot's x265 media encoding benchmarks, it performed better across the range of CPU tests, landing somewhere in the middle of the pack across the rest of the home and work activity tests. Most of these performance units were running hot, so the Blade 15's 970°C max CPU temp wasn't the highest we saw.

The Blade 15 comes with the option of an RTX 2060, 2070 or 2080 and the model we tested was running the most powerful of the three, so it had some of the highest scores of the roundup. The Blade 15 got top marks in most real-world game test with big leads on titles like the *Division 2* and *Far Cry Primal*, but it was surpassed by the Alienware 15's framerates on *Metro: Exodus* with ray tracing on. It did have a lower than expected battery life, but it wasn't bad enough to seriously dull the sleek Razer Blade 15.

Verdict

A great looking and powerful gaming ultrabook that offers no compromise performance.

★★★★½

$4,799 | AU.MSI.COM

MSI GS75 Stealth 8SG

MSI just dropped a bombshell into the gaming ultrabook category.

MSI massively upped its game last year with the GS65 Stealth Thin, receiving full marks from a range of independent outlets, but the GS75 Stealth 8SG we have here may be an even bigger success. At just 1.895mm thick it's almost as thin as its smaller sibling, despite packing an Nvidia GeForce RTX 2080 (Max Q) GPU and a whopping 32GB of RAM. The GS75 Stealth 8SG has the only 17.3-inch display of the roundup, yet its tiny bezels and better screen-to body-ratio make it difficult to tell that the GS75 Stealth 8SG is actually a bigger unit. The 144Hz screen is powered by a generous 80Wh battery that gets 3 hours and 18 minutes in PCMark 8's Home battery benchmark – 30% more than the average laptop here. This unit comes with two 512GB Samsung NVMe PCIe SSDs that are configured in RAID 0, which effectively doubles NVMe SSD write times to an absurdly fast 3407 MB/s.

This unit ended up fractionally below average on direct CPU processing benchmarks, but it managed to do better in general work and home computing tasks edging above the middle of the pack. The GS75 Stealth 8SG generally had fps averages around 5% behind the top performing RTX unit on real-world game benchmarks, but it was never more than 10% off the leader.

The GS75 Stealth 8SG's keyboard does feel a little mushier than many of the offerings here, but it's at least nice to type on and the new ultra-wide trackpad is an awesome addition that looks and feels great.

Verdict

The GS75's combination of features and performance make it the device to beat this year.

★★★★★

RTX 2070

$2,399 | ASUS.COM/AU

Asus ROG Zephyrus S GX531

Is the RTX Zephyrus full of hot air or does it carry water?

The Zephyrus has been one of the more innovative gaming ultrabooks we've seen in the past couple of years. It pioneers a pop-up rear ventilation system alongside the launch of Nvidia's Max-Q mobile cards and fundamentally altering the keyboard layout to have a vertical trackpad that sits to the right of the keyboard and doubles as a number pad. These features have both been well received, and continue to give this year's models a much thinner profile and the ability to use the WASD keys without having to rest your palm on a hot laptop chassis.

The Zephyrus S GX531 is running the same Intel Core i7-8750H / 16GB RAM combo as all the other units here, but the model we looked at was paired with a Nvidia GeForce RTX 2070. This unit performed within 10% of the average across all CPU benchmarks but its compact chassis did bump up the GPU max temperature by 7% to a high of 820°C. Despite running hotter, the graphical performance wasn't impacted significantly, with the Zephyrus still able to push games like *The Division 2* and *Total War: Warhammer 2* above 60fps on 1080p Ultra settings. While the 63.8Wh lithium-ion battery performed well considering its capacity, it still only managed 2 hours and 17 minutes, which was a little disappointing for the gaming ultrabook category. The Zephyrus S GX531's 15.6-inch screen was one of the more vibrant on offer, but the M.2 SSD only gets read and write scores of 1709.2/955.1 – more than 40% lower than NVMe SSDs.

Verdict

A well rounded gaming ultrabook with unique perks and is great value if you can get it on sale.

★★★★½

$3,399 | GIGABYTE.COM/AU

Gigabyte Aero 15X

The 2019 Aero 15 looks like another winner from Gigabyte's Aero family.

Gigabyte was ambitious this year, adding a top-of-the-line Core i9 RTX 2080 configuration to its Aero 15 offerings, but the gamble on this model didn't exactly pay off since it suffered from thermal throttling and a major price hike. We've looked at the Gigabyte Aero 15X here which has a loadout of an Intel Core i7-8750H CPU, an Nvidia GeForce GTX 2070 (Max-Q) GPU and 16GB of RAM. While this is a pretty standard configuration, Gigabyte does offer the largest battery of the bunch at 94.2Wh. Despite being 17.8% bigger than MSI's GS75 Stealth 8SG, the Aero 15X's lithium-ion battery actually ran dry 14.1% earlier when running with a more intensive 15.6-inch 4K screen. We'd recommend opting to save yourself the $800 it'll cost to bump the screen to 4K and double the RAM allocation instead.

The Aero 15X still has one of the smallest footprints with an envelope of 356.4 x 250mm, and it weighs in at 2.11 (impressive considering the battery allocation). While the PCMark 8 Scores here were 15% lower than average, this may be due to software iterations since all other CPU benchmarks were only about 1-2% off the average. Like the Zephyrus, the Aero 15X's GPU runs hot at 860°C but, again, this didn't seem to negatively affect graphic performance with most games running at 60+ fps averages.

New features that might sway early adopters include Microsoft's machine learning power management system Azure AI (which can bump frame rates by 15% on some games), and a neat control centre to make sure you are never running old drivers.

Verdict

A compact RTX gaming ultrabook that offers premium performance for a reasonable price.

★★★★½

$3,169 | LENOVO.COM/AU

Lenovo Legion Y740 (15)

A formidable opponent or just another face in the crowd?

When you consider its direct competitors are the ROG Zephyrus and the Gigabyte Aero 15, Lenovo's Legion Y740 isn't much to look at. Yes, the rear interface hub is useful and the grey metal complexion would slip neatly into any workspace, but its appearance is so bland that you might lose this RTX gaming rig amongst the most drab workstations.

On paper the 15.6-inch 144Hz screen looks the same as the other screens on offer here. It is however, significantly less vibrant with a peak nit brightness of 300 and a poor anti-glare coating that washes it out. It may be the dullest of the bunch but this screen goes some way to redeeming itself by including Nvidia's G-Sync technology, which will allow you to prevent screen tearing and unwanted artifacts at whatever framerate your card spits out. And the Legion Y740 is capable of throwing down some pretty fast frame rates, pushing averages above 60fps on everything except *Ghost Recon: Wildlands* at 1080p Ultra settings.

We were impressed by the overall CPU performance of the Lenovo Legion Y740 too, since it reliably performed between 5% and 20% better than the average benchmark results in both raw CPU tests and general working tasks.

The keyboard doesn't offer much resistance or travel distance, the track pad is unnecessarily small and the 57Wh battery was the smallest of the bunch, lasting just 1 hour and 34 minutes in PCMark 8's Home battery life benchmark.

Verdict

If you need G-Sync then this is your only option from this group.

★★★☆☆

RTX 2060

$2,768 | AFTERSHOCKPC.COM.AU

Aftershock Apex 15X

Is Aftershock's RTX unit at the top of the gaming-laptop mountain?

We're a little on the fence about Aftershock's Apex 15X. In many ways it's a reasonable entry-level gaming laptop, but when you consider it costs $2,768 on special, it's a bit of a hard sell. As this goes to print there will still be a number of retailers trying to sell laptops with Nvidia's 10 series GPUs. We saw an Aorus X5 v8 with an i7-850H CPU and a GTX 1070 going for $2,599 and a 2018 Razer Blade with a GTX 1070 going for $2,859, and while these units are older, they perform as well, if not better than, the Aftershock Apex 15X. That said, if you are really keen on Nvidia's new ray tracing features then you're going to side with this particular unit.

One of the first things we noticed was that the Apex 15X is wrapped in a lot of brushed aluminium, the same kind we used to give MSI grief about because it makes premium devices look cheap. And while the edge-to-edge keyboard and trackpad look nice, both felt extremely flakey. The keyboard was shallow and mushy, with either a lack of n-key rollover or just very imprecise actuations since it regularly missed producing letters while typing, while the trackpad rattled when clicking, making you feel like it might break at any moment.

The Aftershock Apex 15X performed much better showing a 10% bump on the multi threaded Cinebench CPU benchmark and sitting around average on all general working tasks. Graphically it was only between 6 and 14% behind the average game framerates of the 2070 units in this roundup, and it was over 5% better than the Metabox Alpha X on all gaming titles.

Verdict

An entry level RTX laptop that performs well but could do with an interface upgrade and a price cut.

★★★½☆

$3,099 | DELL.COM

Dell G5 15

Is Dell's latest G5 a bright light or a whitewash?

Dell's white Special Edition G5 15 has one of the most innovative gaming laptop chassis designs we've seen in the last few years. While it doesn't compete on footprint or overall thickness, it embraces a boxier aesthetic by riffing on last year's DeLorean-inspired G5 vent design, and adds a little flair by throwing some ultramarine blue thermal-management components behind a perspex undercarriage vent.

There's a bit of back and forth in this unit, which seems torn between wanting to be one of the most premium devices available and trying to meet market demands. While the G5 15 unit we tested had just a Nvidia RTX 2060 GPU, it had also been fitted with a pair of 512GB NVMe drives in a RAID 0 configuration for 2700+MB/s read and write speeds. We were supportive of this feature on MSI's $4,800 GS75, but it's a little silly to think that you'd pay for this extravagant speed bump on the G5 15 when you could get the ROG Zephyrus S GX531 with an RTX 2070 for less.

The CPU performed within 5% of the average across all the general work and direct processing benchmarks and while it was generally about 15% lower than the average framerates in the roundup on graphical tasks, we did pit it against more powerful 2070s and 2080s. This translates to framerate averages of 56 and 41.33 on games like *The Division 2* and *Ghost Recon: Wildlands* using Ultra 1080p settings, respectively.

Dell has somehow managed to squeeze 5 hours and 14 minutes out of a generous 90Wh battery when under PCMark's Home battery life benchmark load.

Verdict

Great battery life and awesome design are marred by a higher than expected price tag.

★★★★½

$2,203 | METABOX.COM.AU

Metabox Alpha-X NH58ED

Does this budget offering manage to be more than just another RTX box?

If you've read up on ray tracing then you'd know it's a rather demanding technological leap. This might make it debatable about whether to bother looking at the lower end of RTX cards when you can nab an older laptop with a more powerful GTX card on a solid discount. We're not going to argue with this logic, but if there was a device that made a compelling case for a budget RTX gaming laptop it's the Metabox Alpha-X NH58ED. While this unit's RRP is $2,603, you could get it on sale for as little as $2,203 at the time of writing, just a couple of hundred more than what you'd expect to pay for a light gaming laptop with a mid-range Nvidia GPU. For this, you get an Intel Core i7-8750 CPU, 16GB of RAM, a Nvidia GeForce RTX 2060 GPU, a 500GB SATA 3 SSD, and a 15.6-inch 144Hz IPS display.

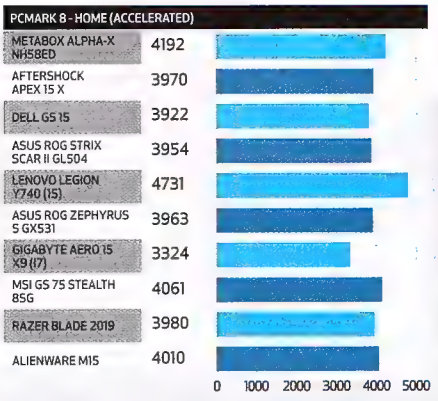
As far as regular work and home office tasks go, this laptop is as good as any here, keeping well within 5% of the average benchmark scores for CPU heavy tasks. If we turn our sights to gaming, the Metabox Alpha-X NH58ED was able to get framerate averages above 70fps on *Far Cry Primal* and *Middle Earth: Shadow of War*, above 60fps on the *Division 2* and was between 8% and 14% behind the 2070 average across all games. This unit does take a hit in battery and it doesn't have a particularly unique chassis, but it offers a lot for the price.

Verdict

It looks a little frumpy, but offers solid performance and is great value when on sale.

★★★★½

LABS BENCHMARK RESULTS


PCMARK 8 - HOME (ACCELERATED)
METABOX ALPHA-X NH58ED 4192
AFTERSHOCK APEX 15 X 3970
DELL G5 15 3922
ASUS ROG STRIX SCAR II GL504 3954
LENOVO LEGION Y740 (15) 4731
ASUS ROG ZEPHYRUS S GX531 3963
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RAZER BLADE 2019 3980
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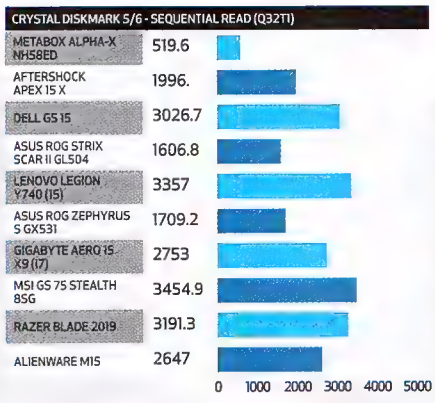
CRYSTAL DISKMARK 5/6 - SEQUENTIAL READ (Q32T1)
METABOX ALPHA-X NH58ED 519.6
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ASUS ROG ZEPHYRUS S GX531 1709.2
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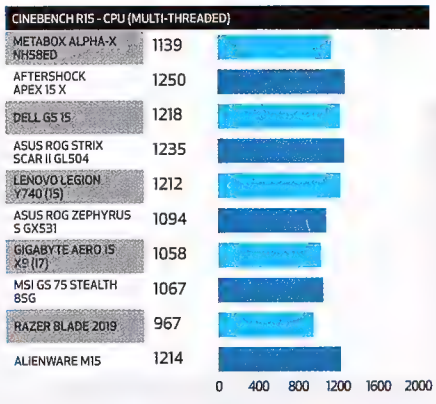
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DELL G5 15 1218
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LENOVO LEGION Y740 (15) 1212
ASUS ROG ZEPHYRUS S GX531 1094
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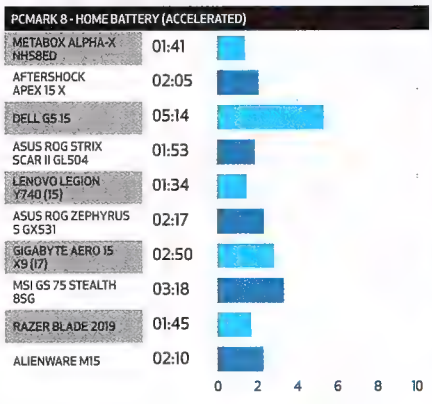
PCMARK 8 - HOME BATTERY (ACCELERATED)
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AFTERSHOCK APEX 15 X 02:05
DELL G5 15 05:14
ASUS ROG STRIX SCAR II GL504 01:53
LENOVO LEGION Y740 (15) 01:34
ASUS ROG ZEPHYRUS S GX531 02:17
GIGABYTE AERO 15 X9 (I7) 02:50
MSI GS 75 STEALTH 8SG 03:18
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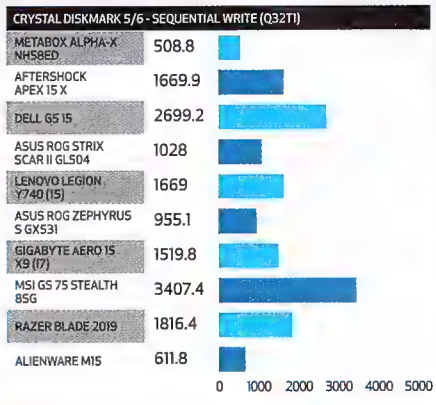
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ASUS ROG STRIX SCAR II GL504 1028
LENOVO LEGION Y740 (15) 1669
ASUS ROG ZEPHYRUS S GX531 955.1
GIGABYTE AERO 15 X9 (I7) 1519.8
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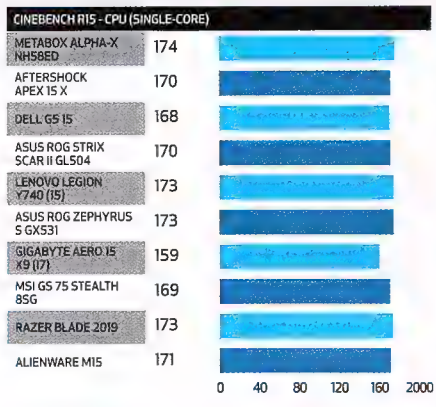
CINEBENCH R15 - CPU (SINGLE-CORE)
METABOX ALPHA-X NH58ED 174
AFTERSHOCK APEX 15 X 170
DELL G5 15 168
ASUS ROG STRIX SCAR II GL504 170
LENOVO LEGION Y740 (15) 173
ASUS ROG ZEPHYRUS S GX531 173
GIGABYTE AERO 15 X9 (I7) 159
MSI GS 75 STEALTH 8SG 169
RAZER BLADE 2019 173
ALIENWARE M15 171
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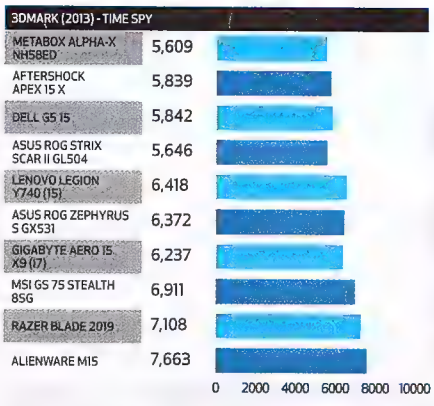
20-SERIES GAMING LAPTOP SPECIFICATIONS

	METABOX ALPHA-X NH58ED	AFTERSHOCK APEX 15 X	DELL G5 15	ASUS ROG STRIX SCAR II GL504	LENOVO LEGION Y740 (15)
STREET PRICE	$2,203	$2,768	$3,099	$2,399	$3,169
SCORE	4.5	3.5	4	4	3
CPU	INTEL CORE I7-8750H	INTEL CORE I7-8750H	INTEL CORE I7-8750H	INTEL CORE I7-8750H	INTEL CORE I7-8750H
MEMORY	16GB	16GB	16GB	16GB	16GB
GPU	2060 (NVIDIA GEFORCE RTX)	2060 (NVIDIA GEFORCE RTX)	2060 (NVIDIA GEFORCE RTX)	2060 (NVIDIA GEFORCE RTX)	2070 (MAX-Q) NVIDIA GEFORCE RTX
STORAGE 1	500GB SATA 3 SSD	512 M.2 PCIE SSD	512GB NVME PCIE SSD (RAID 0)	512MB KINGSTON M.2 NVME SSD	256GB NVME PCIE SSD
STORAGE 2	NA	1TB HDD	NA	NA	1TB HDD
SCREEN SIZE	15.6-INCH	15.6-INCH	15.6-INCH	15.6-INCH	15.6-INCH
SCREEN TYPE	144HZ	144HZ	60HZ	144HZ	144HZ
RESOLUTION	1920X1080	1920X1080	1920X1080	1920 X 1080	1920X1080
SCREEN FINISH	MATTE	MATTE	MATTE	MATTE	MATTE
BATTERY CAPACITY	48WH	46.7WH	90WH	66WH	57WH
DIMENSIONS (MM)	361 X 258 X 27.9	359 X 240 X 19.9	364.3 X 273.4 X 23.7	361 X 262 X 26.1	361 X 265 X 23.85
THICKNESS	2.8CM	2CM	2.4CM	2.61CM	2.4CM
WEIGHT	2.2KG	1.95KG	2.68KG	2.4KG	2.2KG


3DMARK (2013) - TIME SPY
METABOX ALPHA-X NH58ED 5,609
AFTERSHOCK APEX 15 X 5,839
DELL G5 15 5,842
ASUS ROG STRIX SCAR II GL504 5,646
LENOVO LEGION Y740 (15) 6,418
ASUS ROG ZEPHYRUS S GX531 6,372
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MSI GS 75 STEALTH 8SG 6,911
RAZER BLADE 2019 7,108
ALIENWARE M15 7,663
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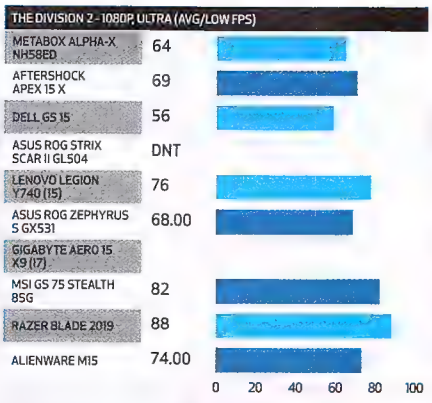
THE DIVISION 2 - 1080P, ULTRA (AVG/LOW FPS)
METABOX ALPHA-X NH58ED 64
AFTERSHOCK APEX 15 X 69
DELL G5 15 56
ASUS ROG STRIX SCAR II GL504 DNT
LENOVO LEGION Y740 (15) 76
ASUS ROG ZEPHYRUS S GX531 68.00
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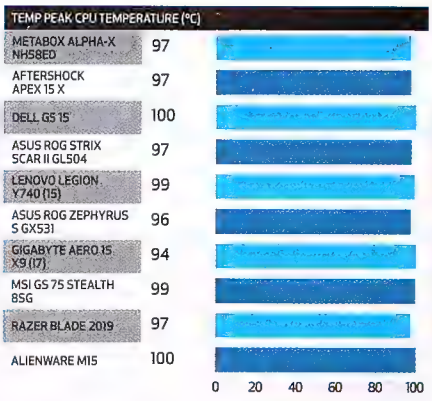
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DELL G5 15 100
ASUS ROG STRIX SCAR II GL504 97
LENOVO LEGION Y740 (15) 99
ASUS ROG ZEPHYRUS S GX531 96
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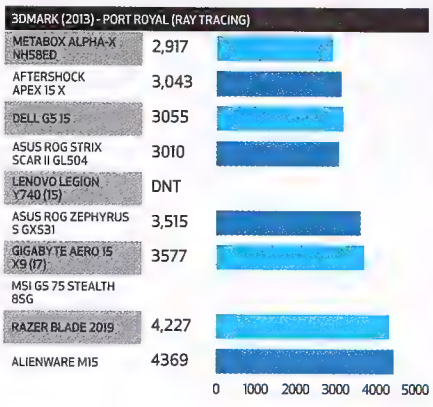
3DMARK (2013) - PORT ROYAL (RAY TRACING)
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DELL G5 15 3055
ASUS ROG STRIX SCAR II GL504 3010
LENOVO LEGION Y740 (15) DNT
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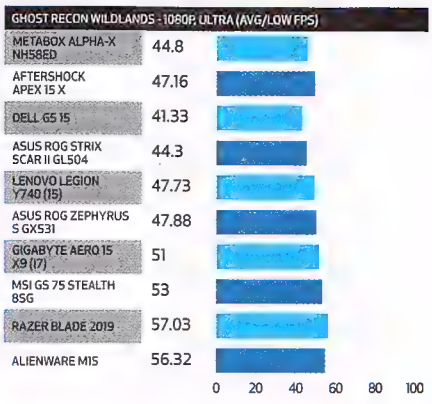
GHOST RECON WILDLANDS - 1080P, ULTRA (AVG/LOW FPS)
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AFTERSHOCK APEX 15 X 47.16
DELL G5 15 41.33
ASUS ROG STRIX SCAR II GL504 44.3
LENOVO LEGION Y740 (15) 47.73
ASUS ROG ZEPHYRUS S GX531 47.88
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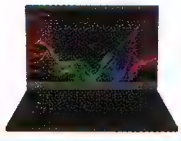


	ASUS ROG ZEPHYRUS S GX531	GIGABYTE AERO 15 X9 (17)	MSI GS 75 STEALTH 8SG	RAZER BLADE 2019	ALIENWARE M15
STREET PRICE	$2,999	$3,399	$4,799	$5,099	$4,898
SCORE	4.5	4	5/1	4.5	4
CPU	INTEL CORE I7-8750H	CORE I7-8750H	INTEL CORE I7-8750H	INTEL CORE I7-8750H	INTEL CORE I7-8750H
MEMORY	16GB	16GB	32GB	16GB	16GB
GPU	2070 (MAX-Q) NVIDIA GE-FORCE RTX	2070 (MAX-Q) NVIDIA GE-FORCE RTX	2080 (MAX-Q) NVIDIA GE-FORCE RTX	2080 (MAX-Q) NVIDIA GE-FORCE RTX	2080 (MAX-Q) NVIDIA GEFORCE RTX
STORAGE 1	512GB NVME SSD	1TB INTEL NVME PCIE SSD	1TB NVME PCIE SSD (RAID 0)	512GB NVME PCIE SSD	512GB NVME SSD
STORAGE 2	NA	NA	NA	NA	1TB HYBRID SSHD DRIVE
SCREEN SIZE	15.6-INCH	15.6-INCH	17.3-INCH	15.6-INCH	15.6-INCH
SCREEN TYPE	144HZ	144HZ IPS OR UHD	144HZ	144HZ	144HZ
RESOLUTION	1920X1080	1920 X 1080 OR 3840 X 2160 (16:9)	1920X1080	1920X1080	1920X1080
SCREEN FINISH	MATTE	MATTE	MATTE	MATTE	MATTE
BATTERY CAPACITY	63.8WH	94.2WH	80WH	80WH LI-I	60WH
DIMENSIONS (MM)	360 X 258 X 15.35	356.4 X 250 X 18.9	396.1 X 259.5 X 18.95	355 X 235 X 17.8	363 X 275 X 21
THICKNESS	1.5CM	1.9CM	1.9CM	1.8CM	2.1CM
WEIGHT	2.1KG	2.11KG	2.25KG	2.1KG	2.16KG

software

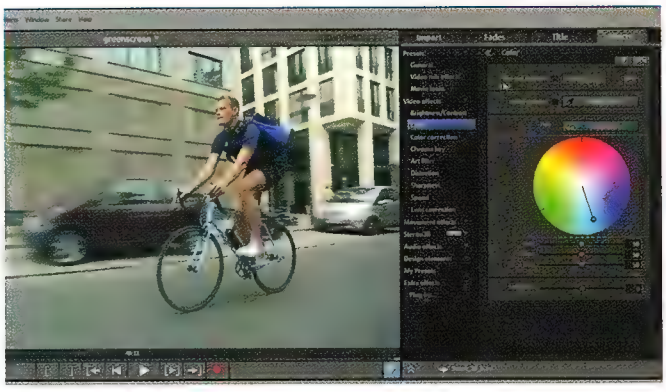
» APPS FOR ALL YOUR PLATFORMS

Windows SOFTWARE

Magix Movie Edit Pro Premium

Could this video editing app have enough versatility to meet your needs?

US$130 | WWW.MAGIX.COM



Based on its current purchase price Magix's Windows-only Movie Edit Pro Premium is a video editing solution aimed at the hobbyist end of the market. As such you probably shouldn't be expecting too much beyond what any bundled app or free software would offer. But Movie Edit Pro Premium is actually remarkably full-featured, has a sleek interface and even grows with you as you improve your editing skills.

It's not without its annoyances and odd design decisions like say not being able to organise your clips prior to using them in a project. Many competing video editing apps allow you to import footage into your project, organise them in bins (aka folders), label them, or do whatever you need to do to have all the clips you need at your fingertips when building a project. Movie Edit Pro Premium doesn't work like that. Instead, if you choose a clip, it's immediately added to your timeline. Choose multiple clips and they're all added in chronological order.

Once your clips are in your project, they appear by default as big square thumbnails. This is Movie Edit Pro Premium's basic interface, designed to keep the editing nice and simple. Top right of the Timeline section are other options represented by a series of icons. The third one from the left offers you a more traditional view, with clips represented by rectangles whose widths depend on their duration. This layout is a welcome adjustment if you're unfamiliar with the editing process, but it isn't so simple that it puts seasoned editors off.

Top right of the interface is known as the Media Pool, which allows you to preview all the app's effects, transitions and titles, and a neat Export tab lets you save a rendered copy to your hard drive, create a version compatible for a mobile device, or upload it to the web.

Movie Edit Pro Premium has a few flaws and annoyances but it covers much more than the basics and even includes automated features which could be a boon for novice users.

Steve Paris

QuickBooks

AFFORDABLE FINANCIAL ORGANISATION FOR YOUR BUSINESS.

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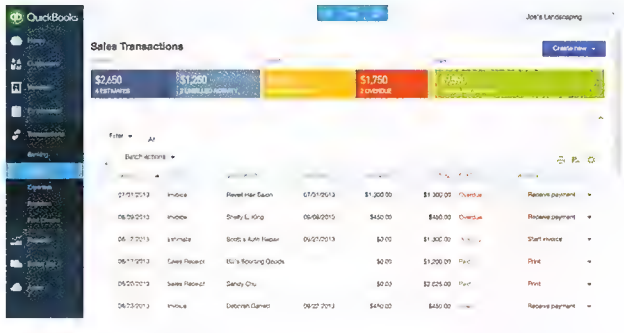


For a small business without a dedicated accounting department, or even a sole accountant, QuickBooks offers an attractive solution to managing the finances. The fundamental bookkeeping ingredients are all here, covering invoices, payroll, estimates, employee time tracking, sales tax, inventory tracking, and is able to sync bank transactions. QuickBooks offers a choice of three online plans or a downloadable version (that is somewhat inferior) to suit a variety of needs.

At $15 per month for a single user subscription, this full-featured app costs more than its competitors. The $30 Essentials Plan adds bill management, timesheets and will accommodate up to three users, while the $40 Plus tier provides project profitability tracking, inventory management and provides logins for five concurrent users. Services such as payroll and time tracking are expensive optional extras that considerably add to the monthly premiums. While a seriously cash strapped business may be better off looking elsewhere for more of a value bookkeeping solution, profitable small business looking for a one-stop-shop won't be disappointed by QuickBooks.

Jonas DeMuro ■

Pixelmash

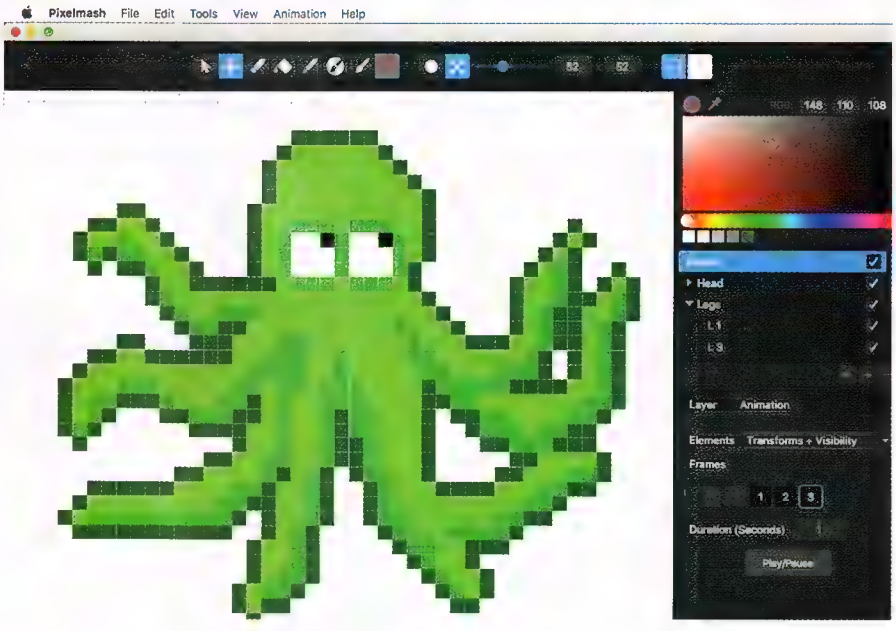
Make low-res art and animations.

$34.99 | NEVERCENTER.COM | NEEDS OS X 10.9 OR LATER

Pixelmash works with a canvas that exists at a higher resolution than you're aiming for. When you import a drawing or photo, rather than converting it to low-res immediately, you can leave it intact while previewing your pixel version. A button toggles between viewing what's stored and the pixellated version. You can even drag a slider to change the pixel resolution live.

This leads on to the app's other special features: effects and animation. Layers are supported, and you can apply shading and outlines to each, or to a master layer. You can also add frames, with 'onion skinning' to see ghosts of other frames while editing, and move, scale and rotate layers frame by frame, enabling animation. You can also choose to show or hide parts of a design.

The approach isn't so helpful when drawing from scratch. The straight line modes of the pencil and brush tools produce lumpy results, there are no shape tools, and the fill bucket works unpredictably. It's not an ideal way to draw. You can export in a variety of formats. Although there are some glitches and omissions, the developers are rapidly adding features. **Adam Banks**



TripMode 2

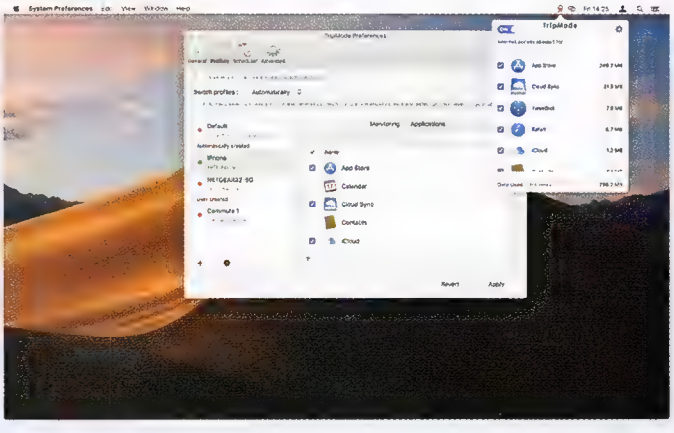
Control capped internet use.

US$7.99 | TRIPMODE.CH | NEEDS OS X 10.10 OR LATER

Use your iPhone on cellular or capped networks and you can limit its data usage. Although macOS has better abilities built in, there's no similar tool bundled in mobile Macs. Travel with your MacBook using your phone as a hotspot or on hotel Wi-Fi and there's no Apple way to track or control your data use.

TripMode monitors internet use for each individual app and process, telling you how much data they've used and giving you fine control. It steps you simply through installation, then you just turn it on in the menu bar; as your apps try to access the internet, it helps you choose which to permit.

You have live control, so you don't waste time adding apps to its control lists. You don't even have to remember to switch control profile, as the app detects when your connection changes from normal Wi-Fi to a tethered mobile hotspot. For those with regular commutes, it has an easy-to-use calendar-based scheduling system to switch to a set profile according to day and time.

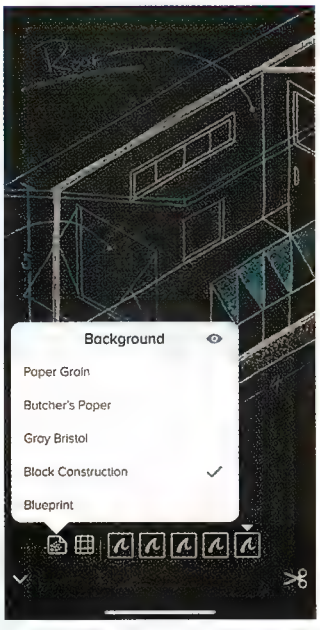


If your Mac uses a capped internet connection, TripMode is a well-designed tool to ensure that you never overrun your allowance and incur costly data charges. **Howard Oakley**

Linea Go

Quick on the draw.

US$1.99 | LINEA-APP.COM | NEEDS IOS 11.4 OR LATER



Linea Go is made for quick doodles, visual notes and perusing Linea Sketch for iPad creations on the move. When drawing, you can add a background texture and grid, and work with up to five layers. The layers have opacity controls, image import capabilities for tracing, and can also be reordered. The toolset is limited: two pencils, two pens and an eraser. You also get a colour picker and a copy/paste/transform tool.

Still, Linea Go does a lot with a little. Drawing is responsive and, thanks to a recent update, makes great use of 3D Touch. The Zip Line feature aids geometric work to straighten and connect lines. Unfortunately, there's no tool for circles. There's a good range of predefined colour sets; pick from a range of shades, or create a custom set. With plenty of crop and export options, and the means to record videos of sketches and broadcast them live, this simple app reveals itself to be surprisingly feature-rich. It is slightly hemmed in on the iPhone. For the most part, though, Linea Go succeeds in being a thoroughly polished, powerful, and compact sketching tool. **Craig Grannell**

Shine

A beautiful moonlit adventure.

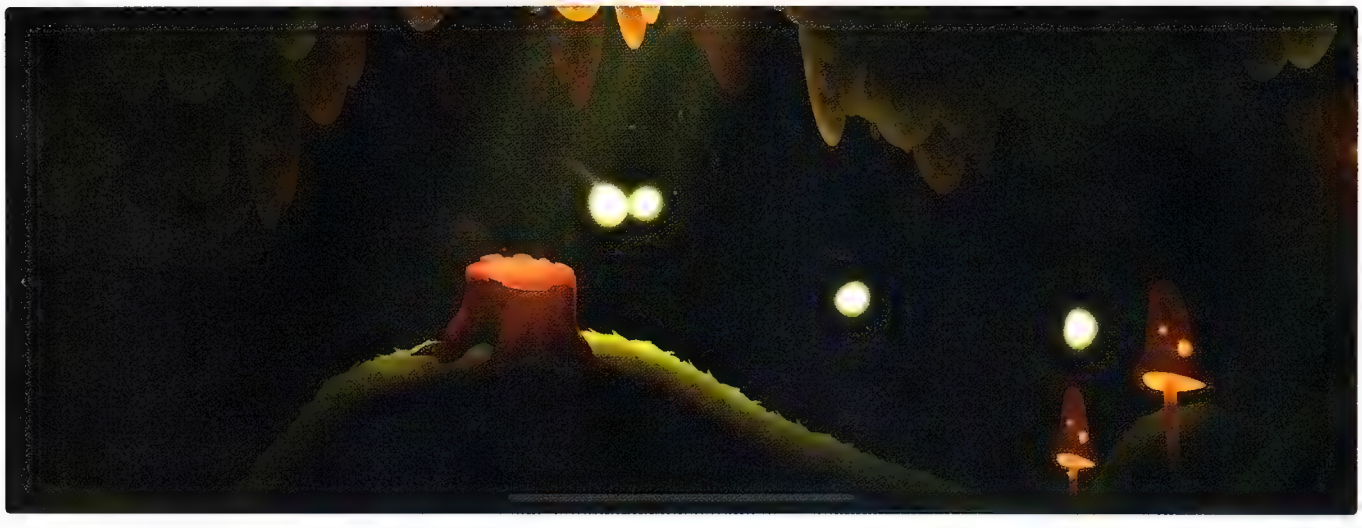
US$2.99 | GAME.COM | NEEDS IOS 9 OR LATER

***Shine – Journey of Light* is not a hard game, but it's still absolutely worth your time. It begins with a mystical story of sorts: the shimmering stars in the night sky are given their gleam by Moonies. One day the Moonies disappear; as the last remaining one, you have to find them and restore light to the inky blackness.**

The gameplay is simple. Your Moonie moves forward automatically; tap the screen and it floats higher. You must traverse tunnels, caves and underwater paths, collecting other Moonies as you go.

Shine is a joy to behold. The effect of your Moonie's light illuminating the pitch darkness is magnificent, and each world is studded with detail. The music (by film composer Christian Maier) is beautiful, soaring at just the right moments, while the sound design has clearly been crafted with care. It's best to wear headphones to truly appreciate it.

It's a shame, then, that the gameplay isn't quite up to scratch. Each level is beaten in much the same way as the last, and it doesn't present much of a challenge. Still, *Shine* is one of the best looking, and sounding, iOS games we've played in a long time. **Alex Blake**



Google Play » ANDROID

Hyperspektiv

Respekt.

FREE/$4.49 PER MONTH FOR PREMIUM | WWW.HYPERSPEKTIV.COM/

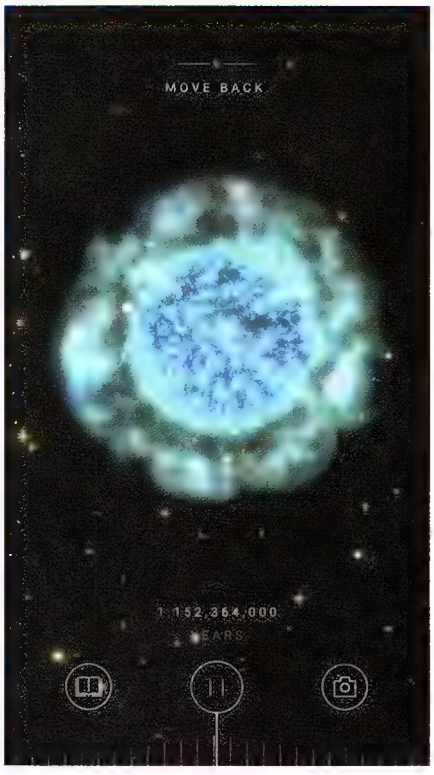
Hyperspektiv recently enjoyed a significant 2.0 update, which has essentially rebooted the app for modern phones with superior cameras and screens. It's yet another photo manipulation and editing app, and these things are a dime a dozen, but it's easy to appreciate how simple and intuitive this one makes the whole process. You can apply multiple filters (several of them are paywalled behind a monthly fee, as is the option for HD videos and photos, but the free selection is strong too), and each one allows you to edit the various effects that are working underneath it. It's a fun way to mess around with your photos and apply weird effects that make them look like something out of a haunted '90s VHS, or an Xbox 360 cyperpunk game with too much lens flare. Hyperspektiv's aesthetic is somewhat played out, though, and while it's a good version of this sort of thing, it doesn't necessarily do anything truly new. Still, it's fun to take a selfie and then weird it up as much as you can

PS4 Remote Play

Dual Shock not required.

FREE | PLAYSTATION.COM

The PS4 Remote Play app feels more like a way of future-proofing Sony's flagship console, and to test streaming technologies, than something anyone is actually likely to want or need right now. By logging into your PlayStation account, you can stream your console to your phone, letting you, theoretically, game on the go. It's a cool thing to be able to do, but don't throw out your Switch just yet. To stream from a console, you're going to need a very strong Wi-Fi connection for it to really work properly, and here in Australia there's a good chance you won't have access to the best connection when you're away from your home console. I was able to stream in my own home but found that the picture quality dropped noticeably. Even if you just want to play *Tetris Effect* in bed, away from the TV, you're going to have to do so with virtual buttons and sticks, mapped all over your phone screen. Game streaming will inevitably grow bigger, but right now there's a lot to be desired here.



Big Bang AR

More than a theory.

FREE | EXPERIMENTS.WITHGOOGLE.COM/BIGBANG-AR

Big Bang AR, created by Google Arts & Culture Lab in collaboration with CERN, is one of the best AR apps we've seen yet. It's more or less what it sounds like – an AR recreation of the birth of the universe, one that speeds through a greatest-hits package of how everything came to be. It starts by examining the opening seconds of existence, as the first particles come together and matter forms, before accelerating, eventually showing millions of years passing in seconds as it explains how stars formed and the universe came together. It's quite lovely, and narrated by the silver-tongued Tilda Swinton. It's about on par with what some museums are doing with AR now, but it's easily accessible from your home – lying on the couch and zooming through creation, occasionally tapping on the 'chapter' button at the bottom of the screen to get more information, is a great reminder of the transportive potential of AR. Running through everything the app offers won't take long, but as a free download, Big Bang AR is essential.

100 POWER TIPS

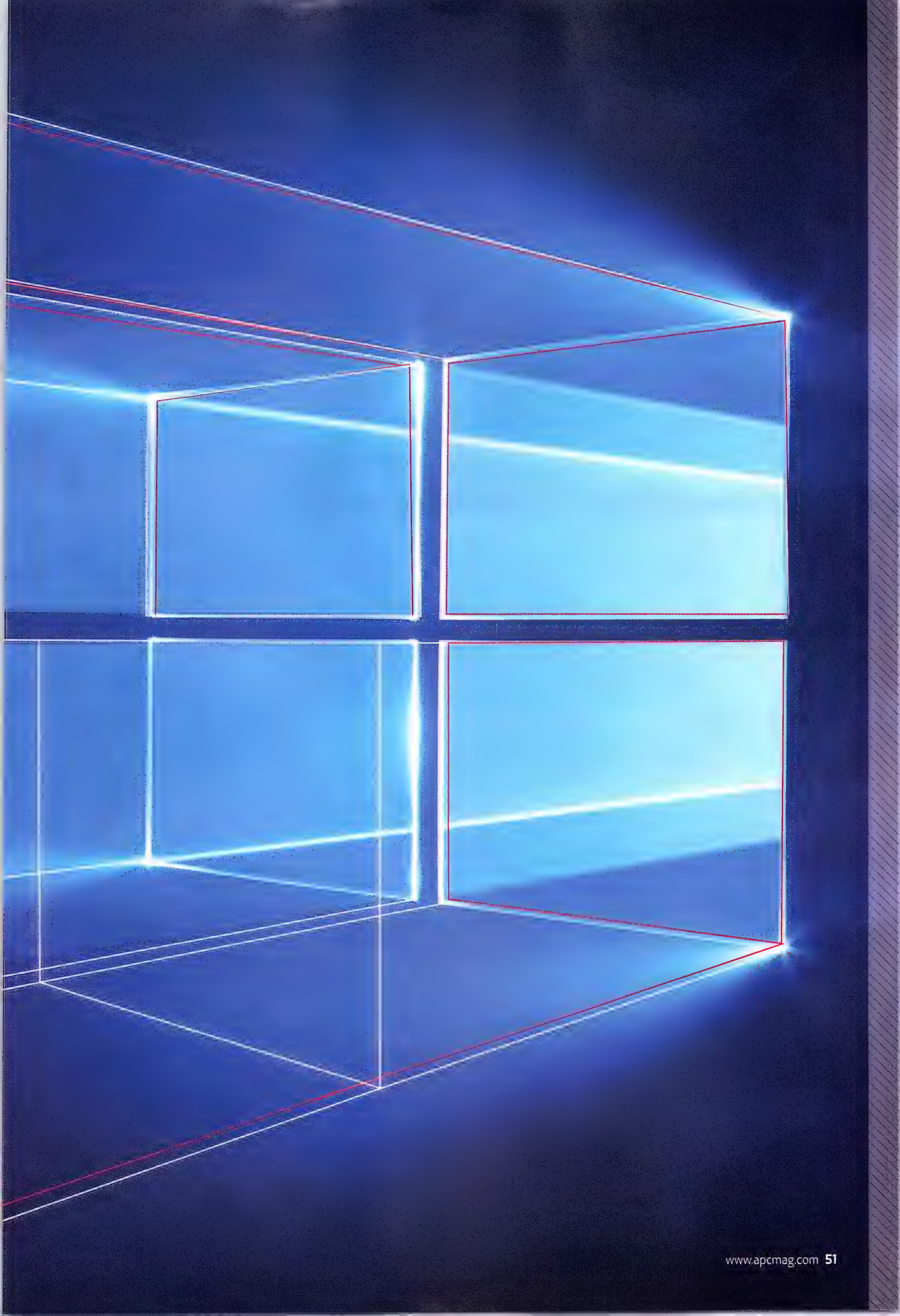
We reveal 100 essential hints, tips and secrets for getting more out of Windows 10.

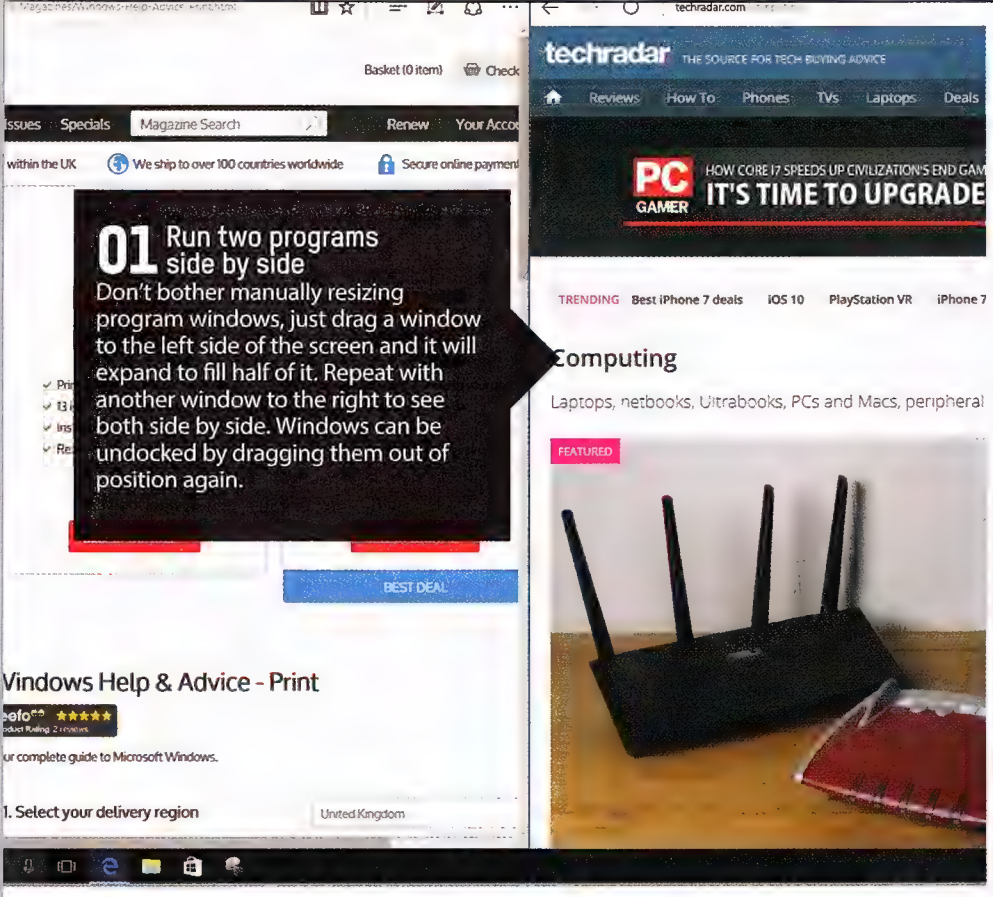
Whether you've been using Windows for years or you're a newcomer to the PC, there's always something new to learn – especially as Microsoft puts out frequent, free updates to improve and occasionally completely change the way its operating system works. There are plenty of hidden tricks in Windows 10's October 2018 Update that will make your day-to-day computing life that little bit easier.

Some tools and options can take time to discover, but there are numerous other perks that you can reveal by scratching beneath the surface of your PC.

Over the coming pages, we'll share some of the best Windows advice, including simple hints such as manipulating your taskbar items, or tricking your computer to more complex tasks such as clearing storage space or creating an emergency boot disk.

These tips are written for the latest release of Windows 10, but many will work with earlier versions too, as features are carried through the generations. Stand on for a wealth of information on Windows 10.




techradar
THE SOURCE FOR TECH BUYING ADVICE
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PC GAMER
IT'S TIME TO UPGRADE
TRENDING
Best iPhone 7 deals
iOS 10
PlayStation VR
iPhone 7
Computing
Laptops, netbooks, Ultrabooks, PCs and Macs, peripheral
FEATURED
01 Run two programs side by side
Don't bother manually resizing program windows, just drag a window to the left side of the screen and it will expand to fill half of it. Repeat with another window to the right to see both side by side. Windows can be undocked by dragging them out of position again.
Vindows Help & Advice - Print
ur complete guide to Microsoft Windows.
1. Select your delivery region
United Kingdom

02 Use pinned folders for really fast access

If you use the same folders often, pinned folders come in handy. To pin a folder to File Explorer's jump list, open File Explorer, then drag a folder into the Quick Access list – not only will it be visible from here, when you right-click the File Explorer Taskbar icon you'll find the pinned folder is there too.

03 Launch a new program window

When a program is running and you click its Taskbar icon you'll switch to that app. If you'd prefer to launch a new window, just hold down the Shift key as you click the icon.

04 Activate Night light

If you're a night owl or find that the blue-white light of your display is straining your eyes, go to Settings > Display and flick the 'Night light' toggle to On. This feature automatically switches your display's backlight to a warmer colour temperature. Job done.

05 Preview program Windows

With more than one instance of a program running you may not be able to tell which one you want to switch to next. To make things a little easier, hover the mouse over a program's Taskbar button to display a preview of any currently running program. Move the mouse over one of the previews and you'll be able to peek at a full-screen preview, then click to switch.

06 Lock with a key press

Stepping away from your PC for a few minutes? Keep it safe by pressing Win-L to lock it. It's that simple!

07 Scroll inactive windows

Windows 10 makes it possible to scroll windows that aren't active – just roll your mouse over the window, then use your wheel to scroll without clicking to select the window. Switch this feature off via Settings > Devices > 'Mouse & touchpad' if it annoys you.

08 Compatibility mode

Some older software that you rely on may not work as you expect under Windows 10. Try right-clicking the shortcut of a program, select Properties, then click the Compatibility tab. Tick the box in the Compatibility Mode section and select the version of Windows it worked with.

09 Taskbar buttons on your terms

Windows 10 saves space by combining windows from the same app into one Taskbar icon. Prefer to see each window individually? Right-click the Taskbar, select Properties and use the 'Taskbar buttons' drop-down menu to choose between the 'Always combine, hide labels' and 'Never combine' options.

10 Calculate and convert

The calculator is capable of much more than adding and subtracting – click the menu button and you'll find scientific and programmer options, a date calculator and various unit conversions, too.

11 Change window sizes with a shortcut

There are lots of ways you can change the size and position of an open window. Hold Win and press the Up arrow to maximise a window or the Down arrow to minimise it. You can also use Win in conjunction with the Left arrow and Right arrow keys to snap the currently selected window to the left- or right-hand side of the screen. Quickly tidy things up by pressing Win-Home to minimise everything except the current window.

Mount
Burn disc image
Open with Notepad++
Run as administrator
Edit with Notepad++
Scan with Windows Defender...
Open with...
Norton Security with Backup
Vivo
Scan with Malwarebytes Anti-Malware
Restore previous versions
22
Burn ISO disc images
Just right-click an ISO file on your machine and select the 'Burn disc image' option. Select the disc burner you'd like to use, insert a blank disc and click Burn.
23 Re-order the Taskbar
Inject some order into the Taskbar by moving taskbar icons. Just click and drag one to its new place – you'll see the other icons move to make way.

12 Make a bigger Start

By switching on 'Show more tiles' within the Start pane of the Taskbar screen in Settings, it's now possible to maximise the Start menu to squeeze in more Live Tiles. Additionally, Live Tiles now take you directly to the content that is being displayed in the tiles, rather than the app's 'home' screen.

13 Quickly rearrange the notification area

If you don't like how icons are ordered in the notification area of the Taskbar, they can be simply dragged and dropped into new positions. Perfect for tailoring the Taskbar to suit your needs.

14 Free up drive space

To keep your PC's drive running well, it's a good idea to clear out the clutter. Type **cleanmgr** into the search bar to quickly launch Windows' own Disk Cleanup tool or get CCleaner from **www.piriform.com** for a more powerful cleaning app.

15 Minimise all windows at once

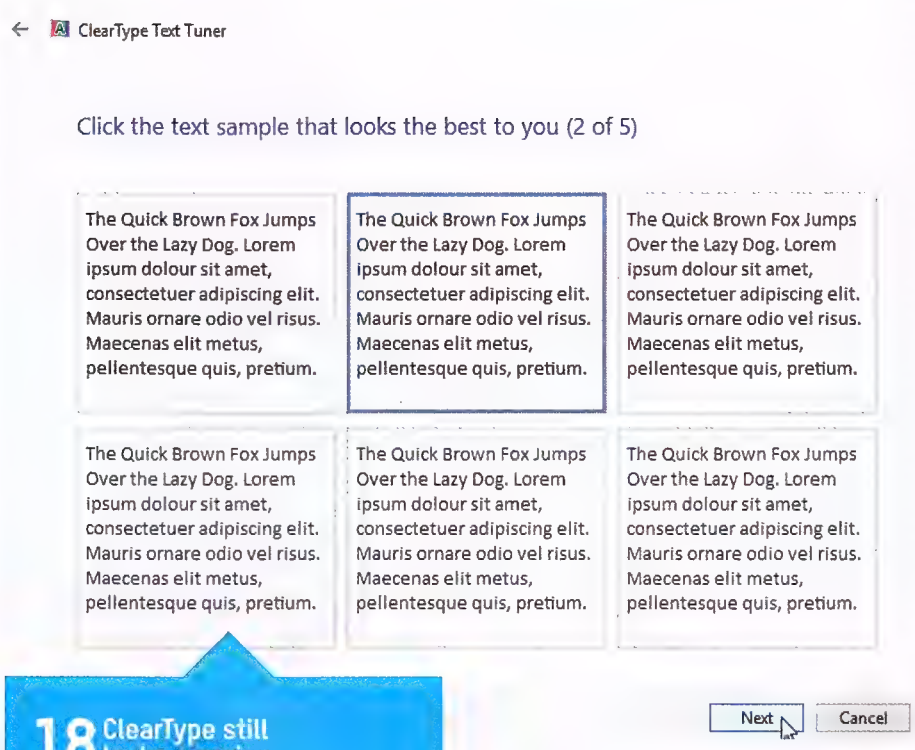
To quickly minimise all of your open programs and windows, press the Win-M key combo at the same time. Alternatively, grab a window with your mouse and shake it. This gesture will minimise all other windows, but leave the shaken one alone.

16 Preview your fonts

Open the Fonts folder from the Control Panel and you can preview the fonts you have installed without even having to open anything. Any you don't need can be hidden or deleted – we recommend backing these up first by copying them to another folder.

17 Select files more easily

When you need to select multiple files, it can be quicker and easier if you use check boxes. Open File Explorer and switch to the View tab. Tick the 'Item check boxes' box and when you roll your mouse over a folder or file you'll see a checkbox appear – tick this to select the file, then repeat for all the others you wish to select.


ClearType Text Tuner
Click the text sample that looks the best to you (2 of 5)
The Quick Brown Fox Jumps Over the Lazy Dog. Lorem ipsum dolour sit amet, consectetuer adipiscing elit. Mauris ornare odio vel risus. Maecenas elit metus, pellentesque quis, pretium.
Next
Cancel

18 ClearType still looks amazing

ClearType ensures text looks great on screen, but it can be fine-tuned to suit. Click 'Start' and type **cttune** to access the ClearType Text Tuner and you'll be guided through the process.

19 Edge extensions

Edge has introduced extensions, which add to its functionality and let you use the web more efficiently. You'll find the usual suspects from competing browsers have already jumped on board – including the likes of AdBlock and Save to Pocket – in addition to other entries, such as OneNote Web Clipper.

20 Avoid the Registry

Want to tweak Windows settings without getting your hands dirty? Download and run Ultimate Windows Tweaker 4 from **tinyurl.com/APC467-REG** where you'll find loads of handy tweaks and customisation settings that require a single click to apply. Set a Restore Point before you begin.

21 Give network locations their own drive letter

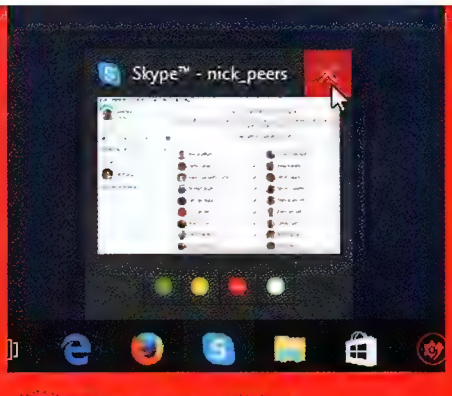
If you have a frequently accessed network folder, why not assign it a drive letter? Navigate to the network location in File Explorer, right-click it and select 'Map network drive' and then choose a letter.

24 Quickly launch Taskbar apps

You don't need to use the mouse to launch programs that have shortcuts in the Taskbar. Press Win-1 to launch the first icon on the Taskbar, and so on.

25 Quickly check the desktop

No need to minimise all your open windows to view the desktop – just move the mouse to the lower right-hand corner of the screen and they'll temporarily vanish.



26 Close apps without switching to them

Just hover the mouse cursor over a Taskbar button and click the red cross located on the upper-right of a preview to close it.

27 Quick and easy command prompt

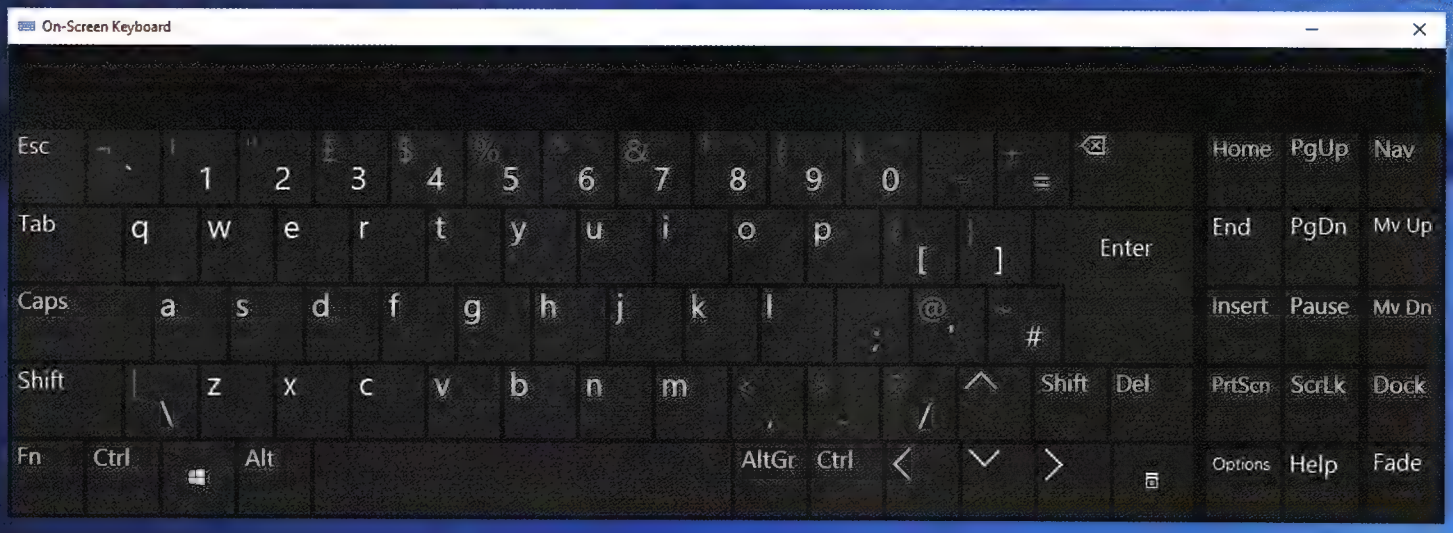
Hold Shift while right-clicking a folder and you'll reveal the previously hidden 'Open command window here' option. This option will take you to that location on your machine in the command prompt window.

28 Show all your drives

If you'd like to see all drive letters at all times, including those with no media in them, click Options under the File Explorer Ribbon's View tab. Select this dialog's View tab, untick the box labelled 'Hide empty drives' and then click OK. You'll now see all your PC's drives.

29 On-screen keyboard

If you're having trouble with your keyboard and need to buy a new one, there's a clever on-screen one you can use in the meantime. Type the command **osk** into the Cortana search bar and press Enter to bring it up.



30 View clocks from other time zones

The Taskbar shows you the current time, and it can also be used to check the time in up to two other countries. Go to 'Date and time settings' in Settings. Scroll down and click 'Add clocks for different time zones'. Tick 'Show this clock' and use the drop-down menu to configure it.

31 Take control of UAC

User Account Control (UAC) is a great, and very longstanding Windows security feature, and you can adjust just how sensitive it is to suit your preferences. Simply click the Start button, type **uac** and press Enter. You can then use the slider to choose when warnings should appear on your Windows 10 desktop.

32 Personalised display calibration

If you like to be in complete control over how your display is calibrated, simply type **dccw** into the search bar to access the Display Colour Calibration Wizard. To proceed, click Next and the wizard will help you to choose the best display settings.

33 Restore classic looks

If you don't like the way items are displayed in the Notification area of the Taskbar (battery, time and date display, and volume control – we're looking at you) then you can restore the old look. Fire up Ultimate Windows Tweaker. Go to Customisation and click the Windows 10 tab where you'll find the options.

34 Cycling backwards

The Classic task switcher (Alt-Tab) still remains – tap it to cycle forwards through the list of windows. Hold Shift as well as Alt and Tab, and you can cycle backwards, too.

35 Disable hibernation, free up space

Windows' hibernation file takes up a lot of space, particularly on machines with lots of RAM. Disable it to recover the space by right-clicking the Start button and choosing 'Command Prompt (Admin)'. Type **powercfg -h off** and press Enter.

36 Run as administrator

You can run any program in the Taskbar in the role of an administrator by simply holding down the keys Ctrl-Shift at the same time.

37 Cycle through a single app

We all know that Alt-Tab is a handy shortcut for cycling through programs. If you want to cycle through just one program's open documents or windows, hold down the Ctrl button and click its Taskbar icon until you access the window you're looking for.

38 Open Explorer at This PC

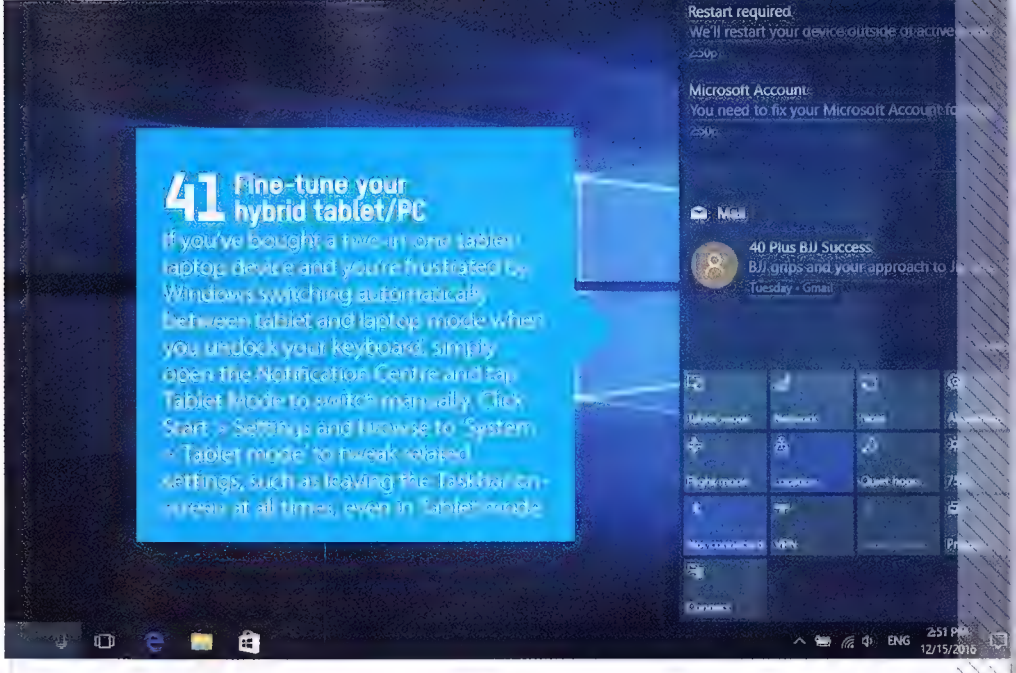
Open File Explorer and it'll default to the Quick Access folder. If you'd rather it went to your drives instead, select Options under the View tab and choose 'This PC' from the window that pops up.

39 Control AutoPlay

Click Start > Settings > Devices > AutoPlay and you can take control of what happens when you insert a disc or plug in an external drive. You can opt to disable AutoPlay completely as well.

40 Leave yourself a note

There's no need to clutter your desk with a hundred different paper notes and reminders – leave electronic reminders on your desktop instead. To do this, launch the Sticky Notes tool from the Start menu and create notes as and when you need them. You can even right-click notes to customise their colour. This simple feature is a great way to help them stand out.


41 Fine-tune your hybrid tablet/PC
If you've bought a two-in-one tablet/laptop device and you're frustrated by Windows switching automatically between tablet and laptop mode when you undock your keyboard, simply open the Notification Centre and tap Tablet mode to switch manually. Click Start > Settings and browse to 'System > Tablet mode' to tweak related settings, such as leaving the Taskbar on-screen at all times, even in Tablet mode.
Restart required
Microsoft Account
40 Plus BJJ Success
Mail

42 Activate windows without clicking

Want to bring your windows into focus simply by rolling the mouse over them? Type **ease of access** into the search bar, then choose 'Ease of Access Centre'. Click the link labelled 'Make the mouse easier to use' and then select the option labelled 'Activate a window by hovering over it with the mouse' in the 'Make it easier to manage windows' section.

43 Gain more desktop space

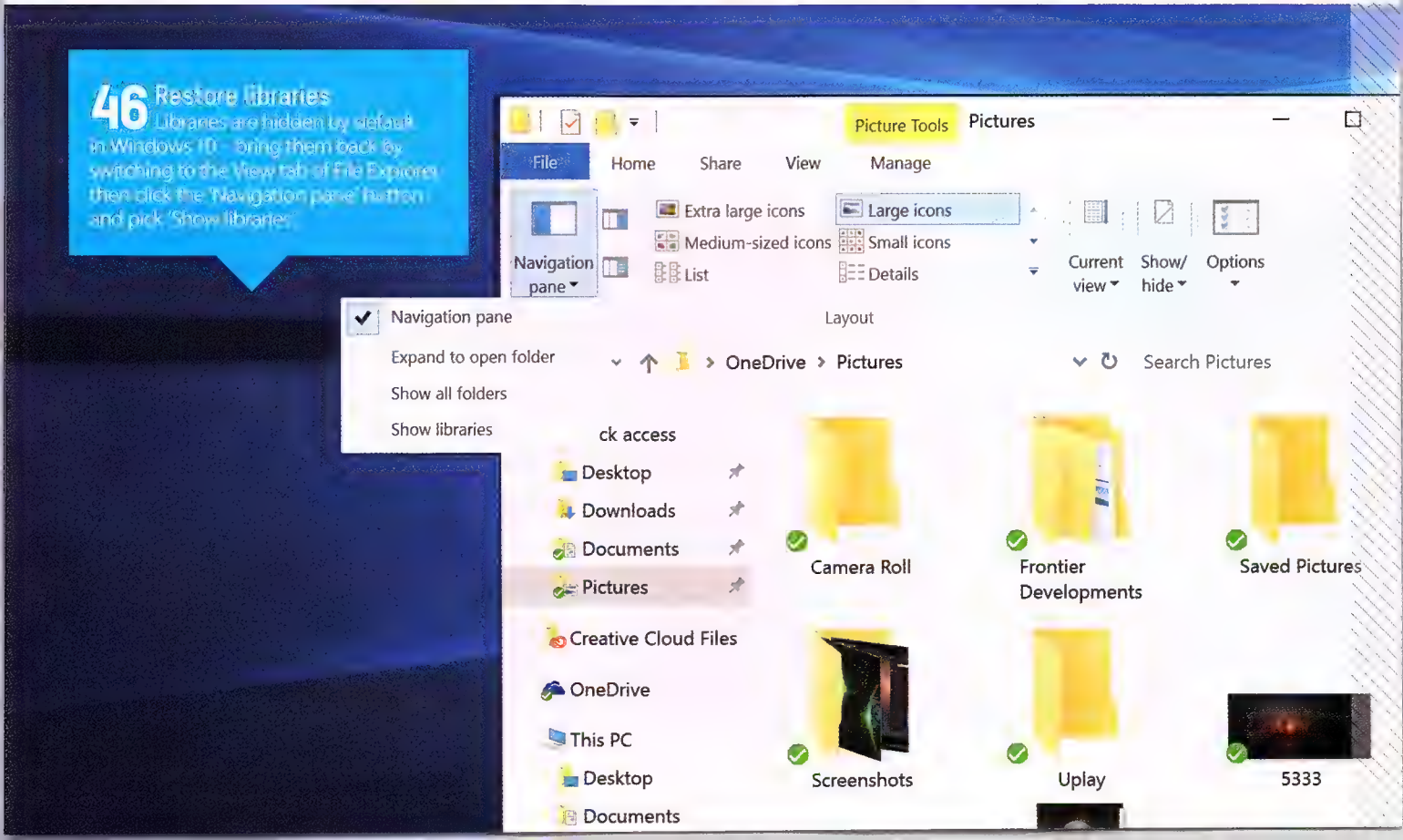
The Taskbar is useful, but you may not need it on display at all times. To maximise the size of your desktop, right-click an empty section of the Taskbar and select Properties. On the Taskbar tab, tick 'Auto-hide the Taskbar' and click OK. The Taskbar will disappear until you move your mouse to the very bottom of the screen – it will then slide into view.

44 Move windows between your monitors

If you have more than one monitor connected to your computer, you can avoid having to drag and drop windows between screens by simply pressing the keyboard combo Win-Shift along with the left arrow or right arrow keys.

45 Task switching and virtual desktops

Windows 10 introduces a brand new Task Switcher – press Win-Tab keys together and you'll see all open windows shrink to fit on-screen. Either click one to switch to it, or drag it to Desktop 2 at the bottom of the screen to transfer it to another (virtual) desktop. You can organise your windows over multiple desktops (click '+' to create new ones) by dragging them to the desired desktop. Hold Ctrl-Win and press the left arrow and right arrow keys to move between your Windows 10 desktops.



47 Side-screen Taskbar

If you'd prefer to make better use of the width of your widescreen monitor, why not move the Taskbar to the left or right rather than the bottom of the screen? This is a great way to reapproach the way you use your desktop. Right-click an empty section of the Taskbar and make sure that the 'Lock the taskbar option' does not have a tick next to it (if it does, just click it to remove it). You can then drag and drop the Taskbar to your preferred position before locking it in place again. Give it a try!

48 Get more from your large monitor

Massive monitors with super-high resolutions can make on-screen text too small to read easily. Adjust this via Start > Settings > System > Display. Use the 'Change the size of text, apps and other items' slider to push things up. Click 'Advanced Settings' to access another dialog box from where you can control specific items.

49 Send To more places

The 'Send To' section of the context menu is very useful. If you hold down Shift while right-clicking a file or folder, you'll see an expanded list of options in the sub-menu that then appears. To delete or add locations for the Send To menu press Win-R and type: **shell:sendto** and then press Enter.

50 Record any of the problems you experience

There may be times when you run into a problem with your computer and you don't know how to remedy it. It can be difficult to explain what's going wrong to someone else, and this is where Problem Steps Recorder can help – it makes it possible to record what happens on screen and send it to someone who might be able to help. Type **psr** into the search bar and choose Steps Recorder. Click the Start Record button and use your computer until the problem you have been experiencing occurs again. Click 'Stop Record' before saving and emailing the file.

51 See how your PC is being used

Windows 10's Resource Monitor enables you to see how your processor, memory and storage drive(s) are being used. Press Win-R type **resmon** and press Enter. The graphs reveal how individual programs and processes are making use of your computer's hardware.

52 Create your own shortcuts

Create your own custom keyboard shortcuts to launch your favourite programs. Right-click a program shortcut and go to the Properties > Shortcut tab, select the 'Shortcut key' field and press the keyboard combo you'd like to use before clicking the OK button.

53 Repair a problematic PC

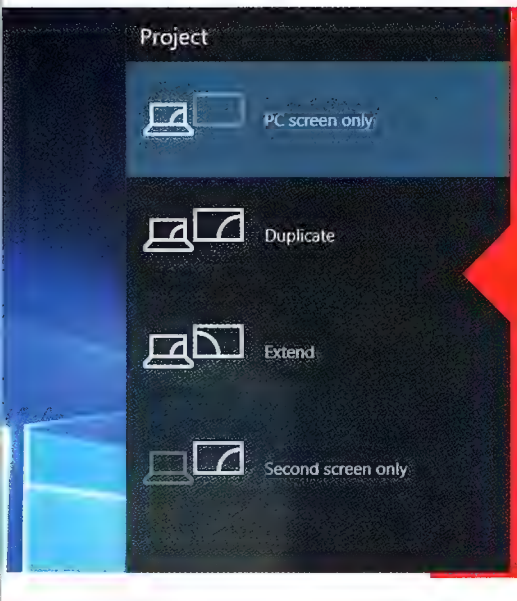
Problems can arise from time to time and you may wish to reboot into one of Windows' troubleshooting modes. To do this manually, hold Shift as you click Start > Power > Restart to boot into the Advanced Start-up screen. You'll find a number of options here. To get into Safe mode, for example, select Troubleshoot > Advanced Options > 'Start-up Settings' > Restart, then select your chosen mode – **4** for Safe mode on its own, or **5** for Safe mode with Internet access – to boot into it.

54 Pin Edge tabs

One of Edge's simple yet really smart features is 'pinning' tabs to save space on the tabs bar. Right-click an open tab and select Pin to do it, and repeat the action (selecting 'unpin') to expand the tab again.

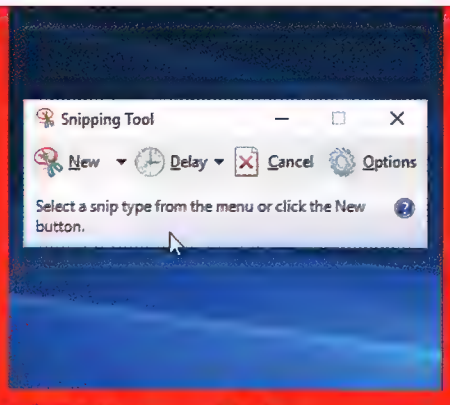
55 Save Office files in WordPad

It might seem like a rather simple tool at first glance, but the WordPad program has more capabilities than you might think. If you click the File option, followed by Save As, you'll find that you're able to save in the DOCX format without additional software – great for quick edits.



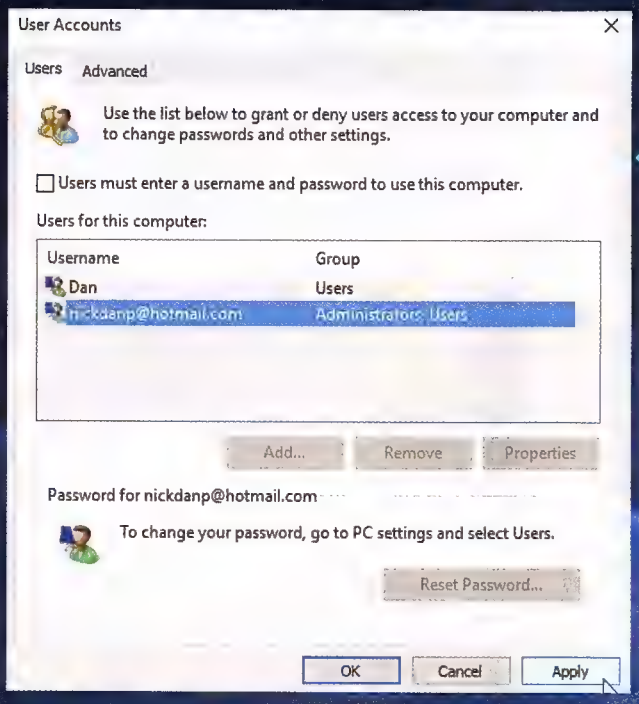
58 Project your desktop

Built-in support for projectors makes connecting your laptop to a projector simple. Simply open Notifications, click Expand near the bottom, then select Project



59 Take screenshots

The Snipping Tool is the perfect way to capture an image of what's happening on your desktop – handy for screenshots and troubleshooting

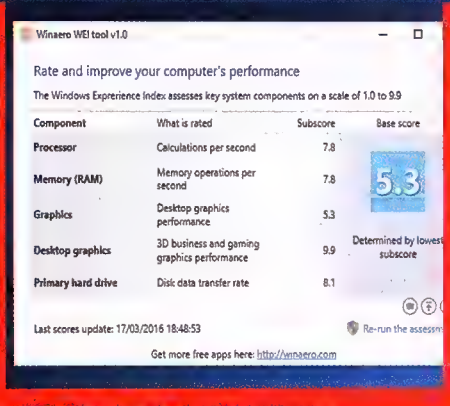


56 Log on automatically

To get to work faster press Win-R, type **netplwiz** and press Enter. Untick the box labelled 'Users must enter a user name and password to use this computer', select your account before clicking Apply and enter your password when prompted. Click OK and you're done!

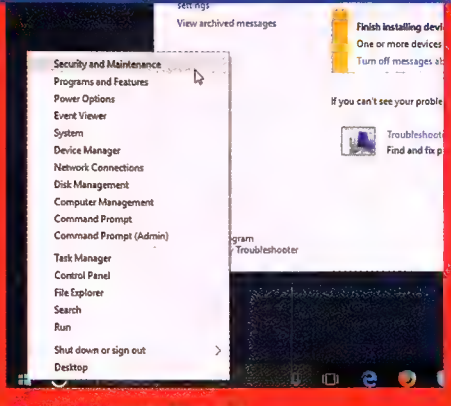
57 Play music on another computer

Windows Media Player can be used to play local or network music files, but you can also push music to play on another computer as well. You need to set this up in advance, so launch Windows Media Player, click the Stream button and then select 'Turn on media streaming'. In the window that appears next, click the 'Turn on media streaming' button. Back in Windows Media Player, click the Stream button again and then select 'Allow remote control of my player' > 'Allow remote control on this network'. Next, select Stream, followed by 'Automatically allow devices to play my media'. Repeat on other computers on your network. Then right-click a music file and select 'Cast to Device' before selecting a PC or other device for playback.



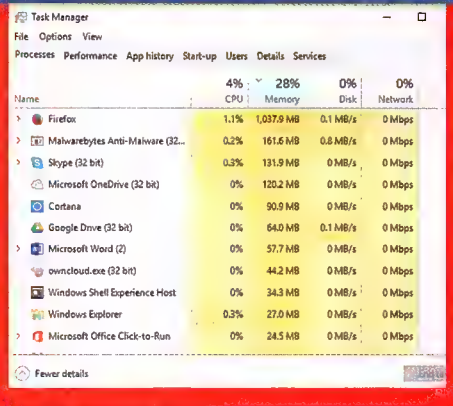
60 Check PC performance

You can manually run the Windows Experience Index tests in Windows 10 by installing the WEI Tool from **winaero.com/download.php?view.79**



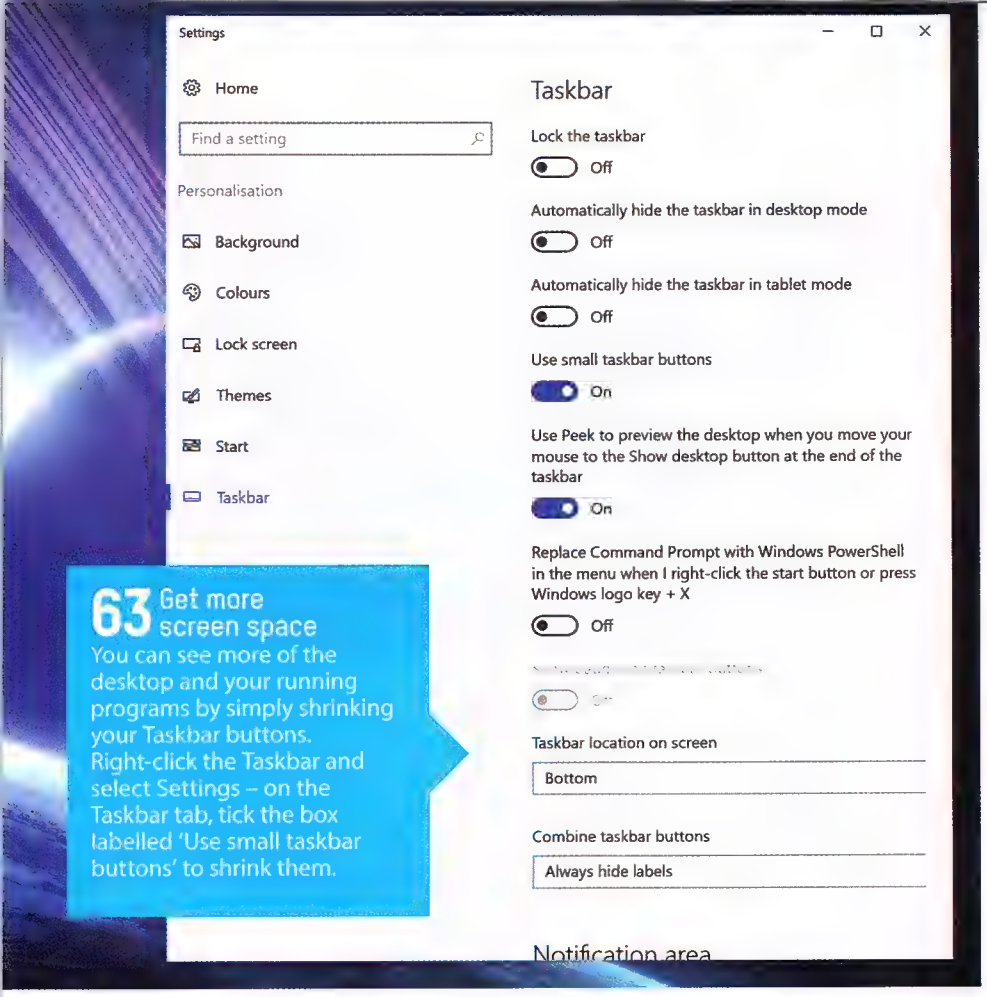
61 Where's the old Action Centre?

Type **action** into the search box and click 'Security and Maintenance' to find notifications of problems and fixit tools.



62 Check your memory usage

To see which programs are using up your memory, right-click the Taskbar and select Task Manager, then click More Details.



63 Get more screen space

You can see more of the desktop and your running programs by simply shrinking your Taskbar buttons. Right-click the Taskbar and select Settings – on the Taskbar tab, tick the box labelled 'Use small taskbar buttons' to shrink them.

64 Old-style Taskbar context menus

When you right-click a button in the Taskbar you gain access to jump lists. If you'd prefer to see options to maximise, minimise and close windows instead, hold down Shift while you right-click the Taskbar button.

65 Restore Windows Photo Viewer

You'll either love or hate Windows 10's new Photos app. If you hate it, this following tweak enables you to restore the classic Windows Photo Viewer app as the default: open Ultimate Windows Tweaker again, switch to the 'Additional' section and click 'Enable Windows Photo Viewer'. Once done, make it the default for viewing photos once again under Settings > System > 'Default apps'.

66 View a slideshow on your desktop

Can't decide which picture to use as your background? There's no need to settle for just one image when you could use a rotating slideshow instead. Right-click the desktop and select the Personalise option. Click the Background drop-down menu and choose Slideshow. You'll be prompted to select a folder containing the images you wish to include – do so and decide how frequently the image will change. This is great for keeping the boring old desktop fresh and interesting.

67 Keep browsing in private

You can keep your browsing history private in the Edge browser by switching to InPrivate mode. You can do this by pressing the combo Ctrl-Shift-P.

68 Get more Taskbar

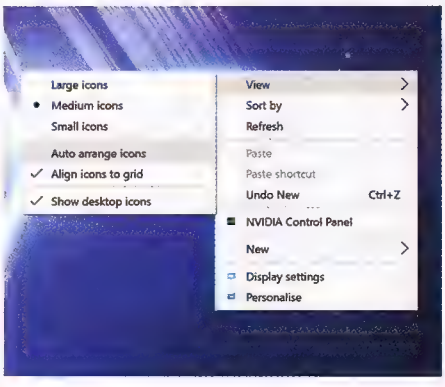
You might want to have a larger Taskbar so you can see more buttons or extra running programs. Right-click the Taskbar and make sure that the 'Lock the taskbar' option is not ticked. You can then drag the top of the Taskbar upwards to make it even taller, too.

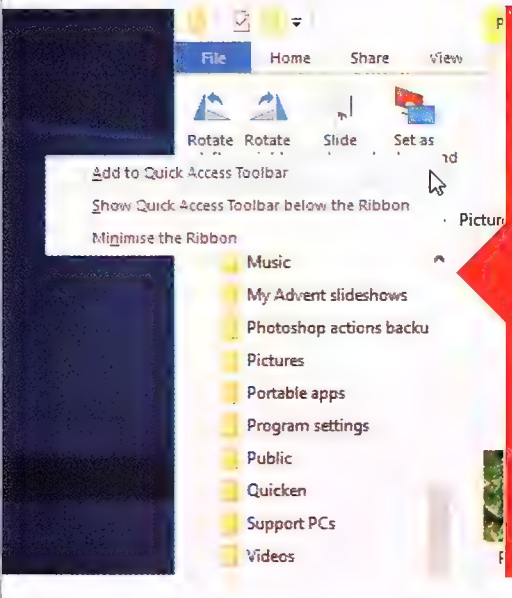
69 Play your music through Cortana

Cortana lets you play music on the lock screen before you've signed in by speaking commands, which is cool, particularly if you're trying to run a headless media PC or similar. To use Cortana with Spotify, sign into the Cortana app, then set Spotify as your music streaming service, then log in to your Spotify account when prompted.

70 Desktop tidying

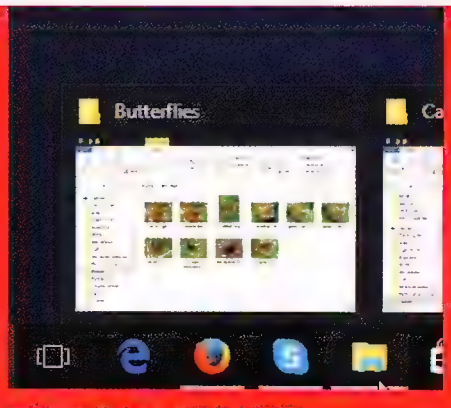
If you have icons scattered everywhere, just right-click the desktop and choose View > 'Auto arrange icons' to keep them in order.





73 Favourite commands

Make your favourite Ribbon commands more accessible in any supported app by right-clicking the option and choosing 'Add to Quick Access Toolbar'.

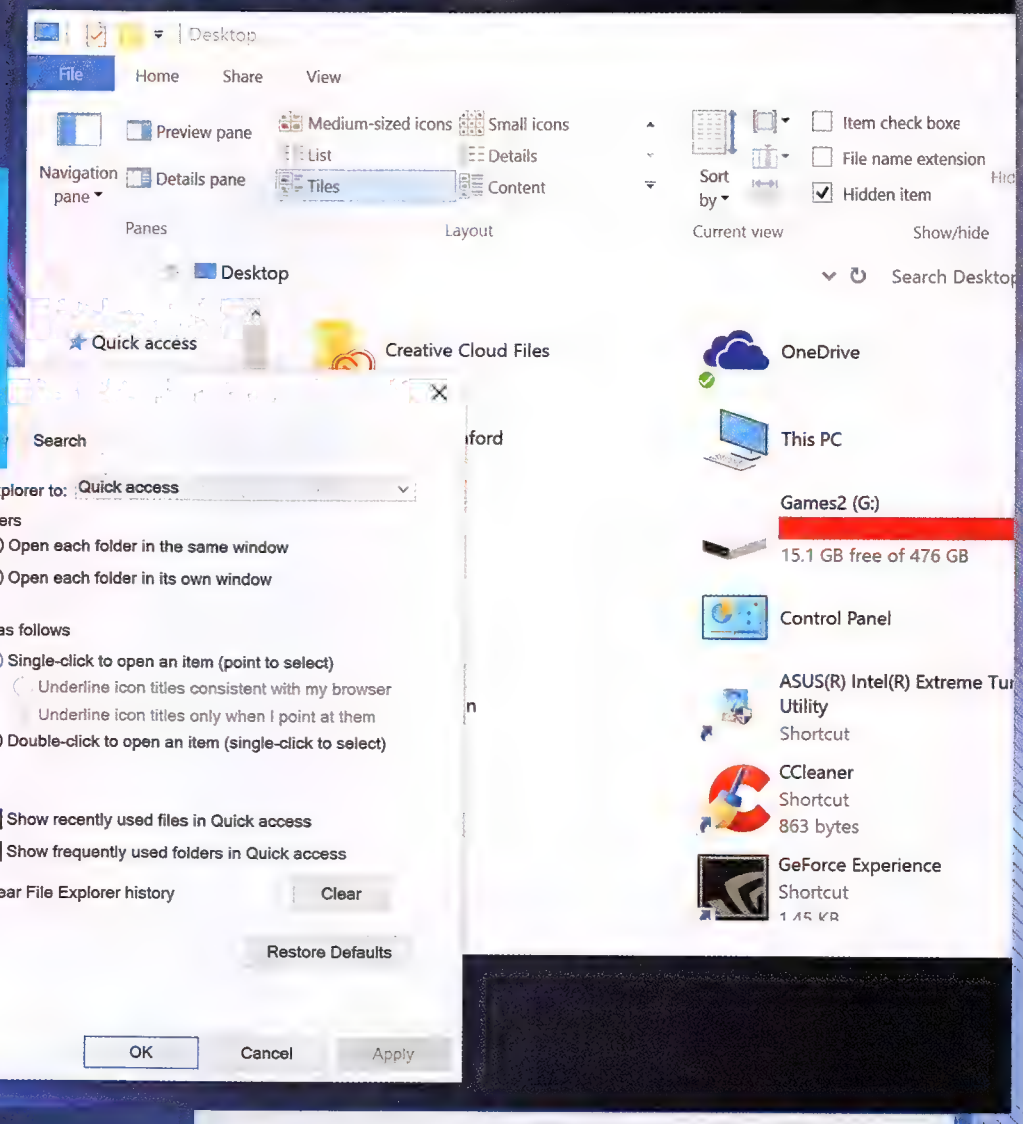


74 Quickly close window

When looking at a Taskbar preview of a program or window, just click the middle mouse button to close the window without having to switch to it.

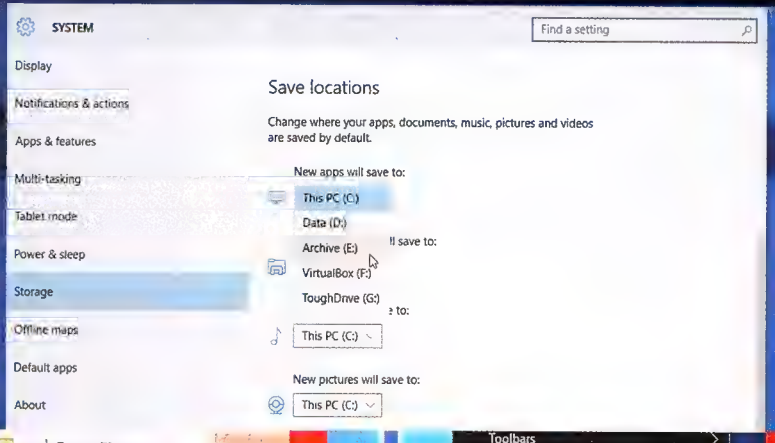
71 Tweak your Quick Access settings

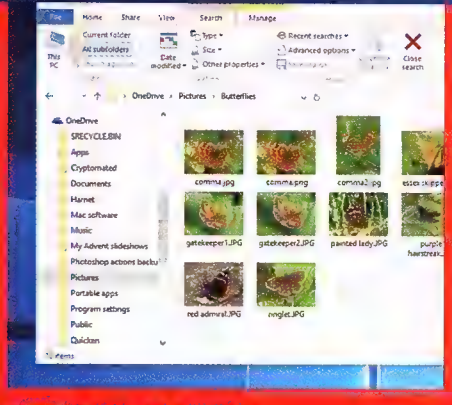
The Quick Access area in File Explorer now juggles frequently and recently accessed folders with pinned folders of your choosing. Switch to the View tab and click Options to choose whether or not to display recent files and frequent folders here.



72 Move your apps to a new drive

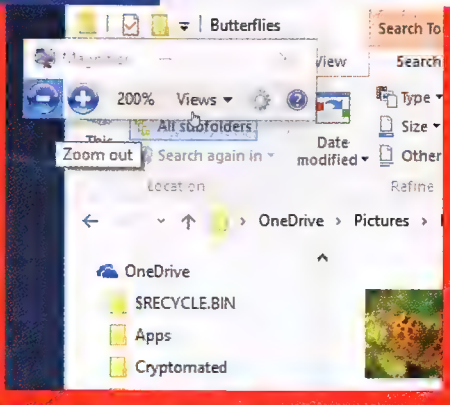
If you're running out of space on your PC – or have a Windows tablet with limited onboard storage – then navigate to Settings > System > Storage and scroll down to the 'Save locations' section. Click the drop-down menu under 'New apps will save to' and select another drive with more space. You can also move some existing Microsoft Store apps if space is tight – switch to 'Apps & features', then click the app you'd like to transfer. If Move isn't greyed out, click it, select your destination and click Move again to transfer that too.





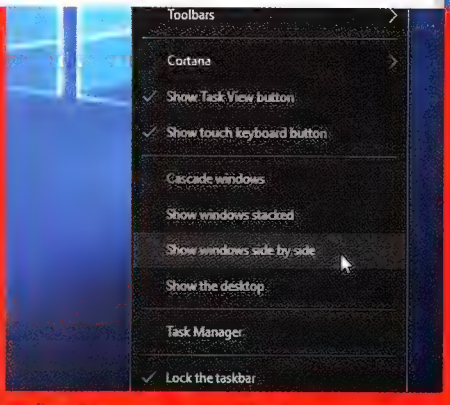
75 Jump to search

When you want to search for a file within a particular folder, simply press F3 to jump to the search box, enter your chosen search term and press Enter.



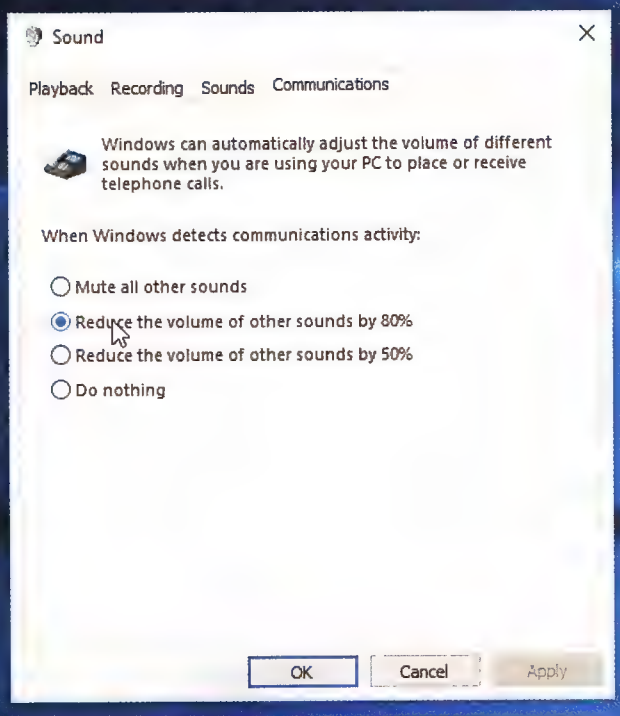
76 Zoom in and out

To get a better view of what's happening on your desktop, or in a program, press Win and '+' to zoom in. Use Win and '-' to zoom out again.



77 Arrange your window

Right-click the Taskbar and click either 'Show windows stacked' or 'Show windows side by side'. You can right-click again to access the undo option, too.


Sound
Playback
Recording
Sounds
Communications
Windows can automatically adjust the volume of different sounds when you are using your PC to place or receive telephone calls.
When Windows detects communications activity:
Mute all other sounds
Reduce the volume of other sounds by 80%
Reduce the volume of other sounds by 50%
Do nothing
OK
Cancel
Apply

78 Reduce system sounds for calls

To prevent the music you're listening to interfering with computer-based phone calls, you can opt to automatically have the volume level of system sounds reduced when a call is underway. Right-click the speaker icon in the notification area and select the Sounds option. Move to the Communications tab and select one of the three options to reduce volume or completely mute sounds.

79 View all notification icons

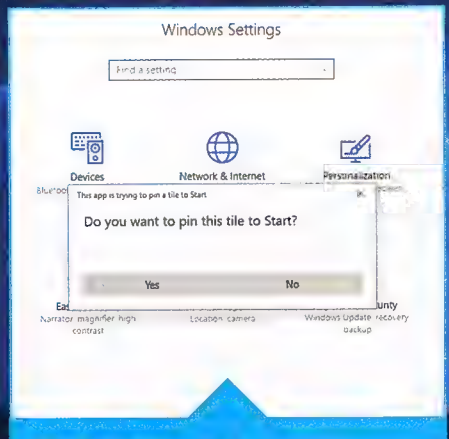
Windows will save space by hiding some icons from the notification area. To see them at all times, click Start > Settings > System > Notifications & actions and click 'Select which icons appear on the taskbar'. Make sure you flick the switch labelled 'Always show all icons and notifications on the taskbar' to On.

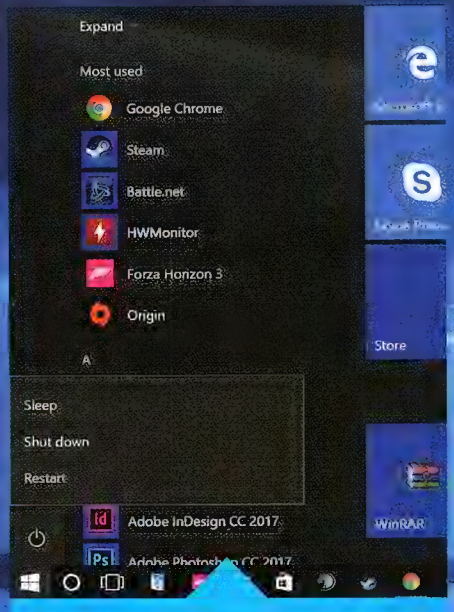
80 Undo that unintentional move

If you accidentally move, copy or send a file to the Recycle Bin on your desktop, you can then press Ctrl Z to reverse the mistake. Phew!

81 Check your energy efficiency

Right-click the Start button and choose 'Command Prompt (Admin)'. Type **powercfg-energy** and press Enter. After about a minute or so of loading, navigate to the folder you're told about (typically C:\Windows\System32) and open up the file **energy-report.html**. This will show you what to do to improve energy efficiency.





82 Make individual Settings accessible

Got a favourite tweak you frequently find yourself burrowing into Settings to find? You can create one-click shortcuts for them in a number of different ways. The simplest thing to do is pin it as a tile to the Start menu simply by locating it in Settings, then right-clicking its entry in the left-hand pane and choosing 'Pin to Start'.

83 Choose your shutdown options

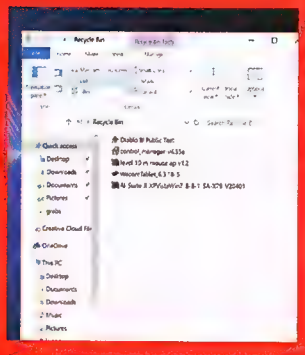
The power button can be used to do many things – Restart, Shutdown, Sleep, and so on – and you can choose what should happen by default. Right-click the Start button and select 'Power options', then click 'Choose what the power buttons do' to access the relevant options.

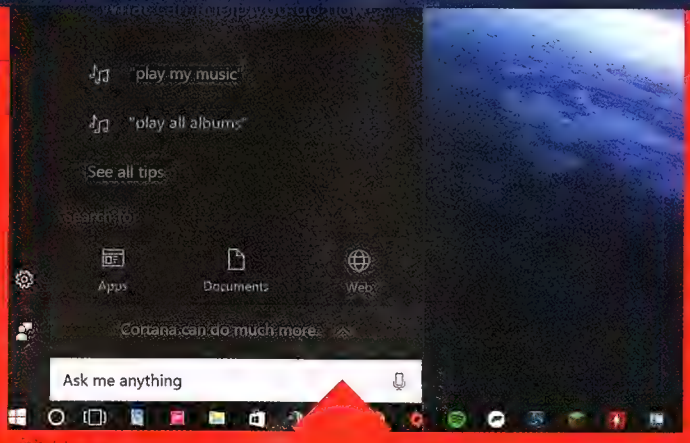
84 Add tabs to File Explorer

File Explorer in Windows 10 is an improvement on Windows 7, but it's still lacking in one key area – no tabbed support to prevent you cluttering up the desktop with multiple windows. Clover 3 is a free extension that adds Chrome-like tabs to File Explorer. Go to **www.ejie.me** to get this free app.

85 Undelete your files

It's easy to forget just how handy the Recycle Bin folder is. If you've deleted a file, document or folder that you need back, simply open the Recycle Bin from the desktop and you'll find that your files are still there ready to be restored.





86 Search with Cortana

Type the name of a file or folder into the Cortana search box and you'll get a load of irrelevant results – click 'My stuff' to search your computer's main drive and other storage, including your OneDrive folder, for your missing files. Use the Show drop-down menu to filter the results.

87 Pin saved searches to the Start menu

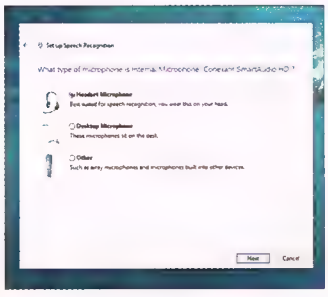
File Explorer's search tool is powerful – for example, you can set up a search to reveal all recently modified Word documents in a folder from that location: just type **type:word datemodified:this week** into Search. Click 'Save search' to add it to your Searches folder, then go there, right-click the search and choose 'Pin to Start'.

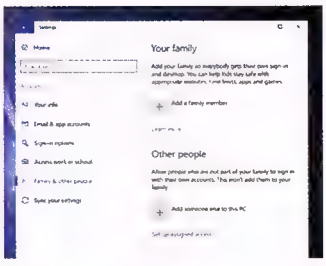
88 Account shortcuts

Click the Start button followed by the Account button above Settings and you'll see some handy extra options: lock, sign out and switch user, plus access the 'Change account settings' screen.

89 Talk to your PC

If you can't type very quickly or just fancy trying out something a little nifty on your new machine, type **speech** into the search box and select Windows Speech Recognition. Here you'll find everything you need to configure your PC for voice-activated control – it's great for dictation, too.





90 Keep an eye on your children

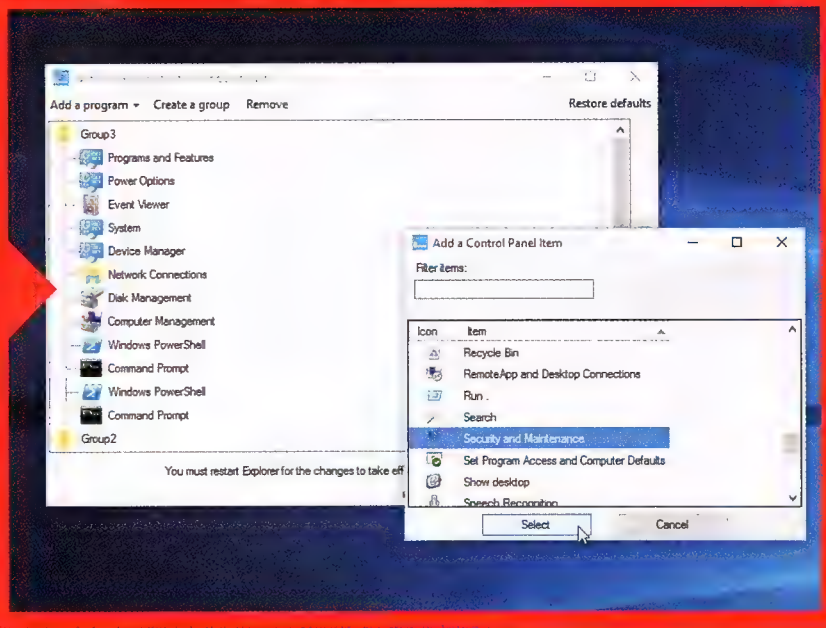
If you have children, you're no doubt faced with the dilemma of letting them use your PC, while also helping them to stay safe. Go to Start > Settings > Accounts > 'Family & other users' to set up user accounts for your children that you can configure to protect them when they're online. You can also manage their PC usage and monitor what they do.

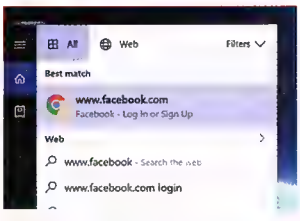
91 All settings in one place

It's something that has been dubbed as Windows 10's 'God Mode', but in reality it's just a fantastically handy way to access a massive range of system options all in one place. Create a new folder and type the name **xxx.{ED7BA470-8E54-465E-825C-99712043E01C}**. You can change the 'xxx' bit to anything you like, and when you open up the folder, you'll be presented with a massive list of Control Panel options to work with, including tweaks not found in the newer Settings app. Just don't go too mad with your new-found power as you don't want to have to resort to system recovery!

92 Make good use of the Quick Access menu

Right-click the Start button or press Win-X and you'll open up a hidden Start menu. It provides a number of convenient shortcuts to powerful tools, including various Control Panel applets, Device Manager and the Command Prompt. Add your own, or rearrange and delete existing shortcuts, courtesy of the Win-X Menu Editor. Download the app from **http://winaero.com/download.php?view.21** where you'll find it's easy to add handy presets like Control Panel applets and administrative tools as well as custom shortcuts.



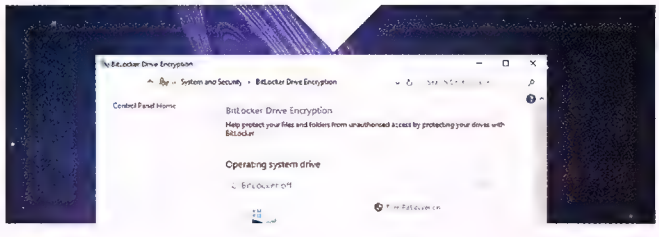


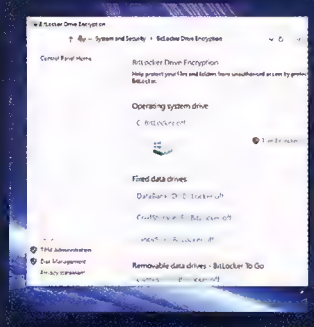
93 Launch a website from the Taskbar

Sometimes it can be too much trouble to switch from the program you are working in, move to a browser and place the cursor in the address bar before typing a URL. Instead, simply type the web address you want to visit into the Cortana search bar and it'll go straight there in your default web browser.

94 Create a USB boot drive

It's good to be prepared and this is where a recovery drive comes in. Type **recovery** into the search bar and choose 'Create a recovery drive'. If you have a Windows install disc, untick 'Back up system files to the recovery drive' before clicking Next, then select a USB flash drive to create the recovery drive on. You can boot from this drive to access repair options when Windows itself won't boot.


BitLocker Drive Encryption
System and Security
BitLocker Drive Encryption
Control Panel Home
Bitlocker Drive Encryption
Help protect your files and folders from unauthorised access by protecting your drives with BitLocker
Operating system drive

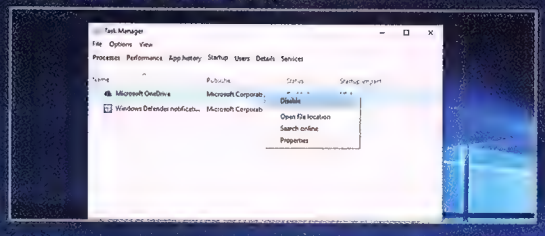


95 Use encryption with your drives

If you're running Windows 10 Pro, type **bitlocker** into the Search bar to switch on Bitlocker drive encryption; if not, download the free Veracrypt app from **https://veracrypt.codeplex.com**.

96 Give your start-up a good speed-up

Type **startup** into the search box and click the best match to be taken to the Task Manager's Startup tab. Disable any programs you know you don't want to start with your computer. This can reduce its boot times significantly.

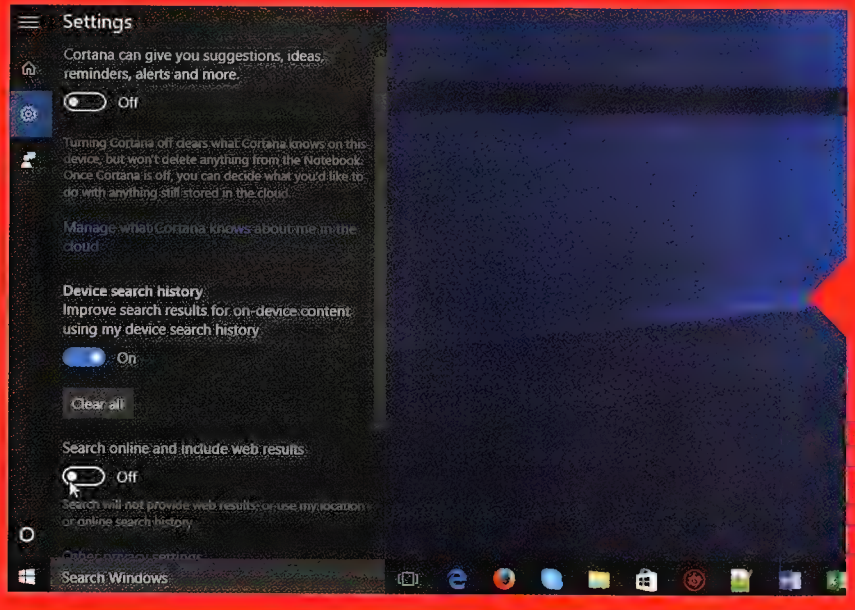


97 Create new folders quickly

There's no need to lift your hands from the keyboard when you need to create a new folder in File Explorer – there's a much simpler way! To carry out this handy little trick, just use the special keyboard shortcut Ctrl-Shift-N, type a name for the folder and press Enter.

98 Personalise your PC's information

You can change what's displayed in the System Properties screen to just about anything you like (within reason). The information is held in the Registry, but why fiddle about there? Instead, fire up Ultimate Windows Tweaker and navigate to the Additional section. Click the 'Edit OEM Information' button and enter your details – you can even include a logo. You'll need to prepare a 120x120px image in your image editor and save it with the BMP extension, otherwise it won't appear.


Settings
Cortana can give you suggestions, ideas, reminders, alerts and more.
Off
Turning Cortana off clears what Cortana knows on this device, but won't delete anything from the Notebook. Once Cortana is off, you can decide what you'd like to do with anything still stored in the cloud.
Manage what Cortana knows about me in the cloud
Device search history
Improve search results for on-device content using my device search history
On
Clear all
Search online and include web results
Off
Search will not provide web results or use my location or online search history
Search Windows

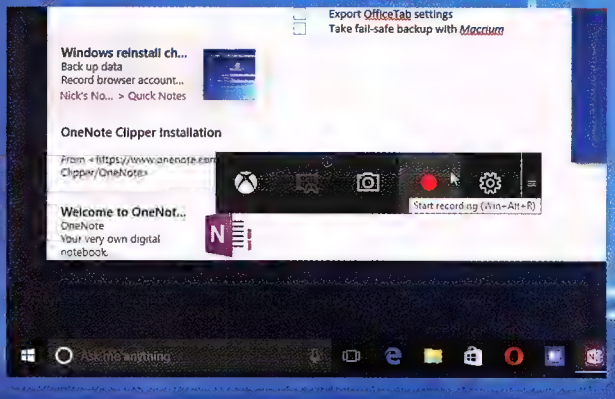
99 Restrict Cortana

By default (see tip 86), Cortana favours web results over locally stored content when using generic search terms. You have to click My Stuff to search locally. If you have no use for Cortana as a web search tool, disable it – open Cortana and click the notebook icon (a rectangle with a circle on it) on the left before selecting Settings. Flick the top switch to Off, which will reveal a new switch – 'Search online and include web results'. Flick this to Off and you'll see the search box now only says 'Search Windows', confirming it's no longer interested in the web.

100 Record app actions in Windows 10

Windows 10 features a Game DVR function, which enables you to record your progress in a game as a movie if its hardware supports it. What's less well known is that this DVR function works with any app you've installed.

Simply press Win-G when inside your target app and tick 'Yes, this is a game' when prompted. If you plan to share your video with others, it makes sense to set it to the correct aspect ratio: 16:9 or 16:10 is usually best.



Final thoughts...

The October 2018 Update to Windows 10 introduced some great new features, but it's easy to remain trapped in a rut, sticking with what you know, even when there are better and often more efficient ways of doing things in Windows. We've covered a wide range of topics and features in this tips extravaganza, but there's plenty more to be found. Take the time to explore the many tweaks on offer – you're bound to find at least one extra useful setting.

We've hopefully revealed dozens of tips you'll find incredibly useful. Simply researching and writing them has uncovered new and better ways of doing things for us, too, and that's ultimately the best barometer of all. If you find something that improves your own way of doing things, then chances are it'll help others as well. ■

PICK A DISTRO

If you're diving into the world of Linux, make sure you pick the right package for you: different distros make a difference.

Your favourite Linux distribution isn't an individual unit in itself. On the inside, it is made up of various apps, libraries, modules and toolkits. On the outside, it's part of a much larger and very vibrant ecosystem that sustains several other distros.

Also part of this larger Linux ecosystem are very active user communities and various support infrastructures that help nourish the distros and other projects. Over the course of their lifetime, the different elements of the Linux ecosystem interact with each other as well as with their environment. They collaborate, exchange ideas and features, and sometimes swap resources for their mutual benefit as well as for the enhancement of the ecosystem.

The Linux ecosystem fosters the development of innovative projects and products. However, since the environment can only sustain so many elements, the distros go through an evolutionary process of their own to weed out the weaklings and ensure the survival of the fittest. Through this process, the uninteresting, dull and unsustainable projects begin to perish. However, the strong ones survive, thrive and pass on their code to the next generation of derivative distros.

In this feature we'll classify the popular distros as per their origins. We'll analyse how they've evolved since their inception, and look at the unique traits they have passed on to derivatives that help distinguish them from their peers. We'll also look at the best distro from each distro genus and then pit them against each other to help you pick the distro that is just right for you.

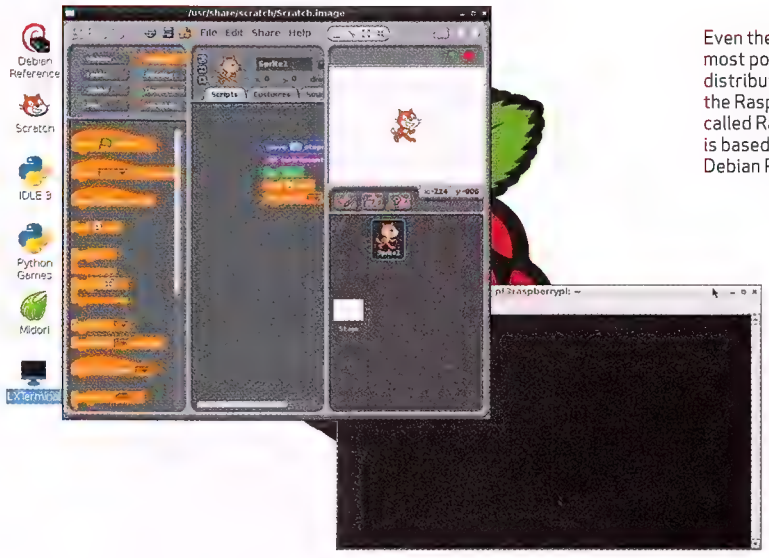
Genus Debian

Made of free software and evolving.

The Debian project has played a significant role in the evolution of Linux and, in many ways, is the first real distribution created for the regular computer user. It was announced in August 1993 and had its first public release later that year, although its first stable release wasn't available until 1996. The project was even sponsored by the Free Software Foundation from November 1994 to November 1995.

A key motivating factor that led Ian Murdock to create a new distro was the perceived poor maintenance and prevalence of bugs in the Softlanding Linux System (SLS) distro. Besides the software itself, Murdock's release included the Debian Linux Manifesto, which outlined his view for the new project, which prophesied that "distributions are essential to the future of Linux". In the Manifesto, he called for the distro to be maintained openly, in the spirit of Linux and GNU. One of the most significant goals for the distro was to "eliminate the need for the user to locate, download, compile, install and integrate a fairly large number of essential tools to assemble a working Linux system". In order to meet this goal, Debian developers made a significant contribution to the Linux world – the *dpkg* package manager.

This was originally written as a Perl program by Matt Welsh, Carl Streeter and Ian Murdock, and the main part of the tool was rewritten by Ian Jackson who became Debian Project Leader in 1998. It really is no surprise then that Debian is one of the most popular choices for derivative projects with over 130 active distros based on Debian (Source: **http://distrowatch.com**), including the likes of Ubuntu and a version of Linux Mint.



Even the most popular distribution for the Raspberry Pi called Raspbian, is based on the Debian Project.

The project also provides guidelines to help the derivative distros merge their work back into Debian. In addition to the derivatives there are several 'Pure Blends'; these are subsets of Debian configured to support a particular niche, such as Debian Edu, Debian Junior and Debian Med. Debian also supports a variety of platforms, including Intel i386 and above, Alpha, ARM, Intel IA-64, Motorola 68k, MIPS, PA-RISC, PowerPC, Sparc and more.

RULES OF ENGAGEMENT

Another distinguishing aspect of Debian is that the distro is made entirely of free software. The project uses the Debian Free Software Guidelines (DFSG) to help determine whether a piece of software can be included. The DFSG is part of the Debian Social Contract which defines the moral agenda of the project.

The project produces three distros: Stable, Testing and Unstable. A Stable release is available every two years and is made by freezing the Testing release for a few months. Testing is designed to be the preview distro with newer packages and during the freeze any bugs are fixed and extremely buggy packages are removed. All releases are named after characters from the *Toy Story* films (the current Stable release is codenamed Jessie). All new packages are introduced in the Unstable release (codenamed Sid). This distro is for developers who require the latest packages and libraries. It's not intended to be used on a production machine and those interested must upgrade Debian Testing to get the latest Unstable.

Linux Mint Debian Edition

The Linux Mint Debian Edition (LMDE) is meant for users who wish to experience the best of Debian (directly rather than via Ubuntu) in an easy to use package. It's based on Debian Testing and is a semi-rolling release, which means it receives periodic updates via Update Packs. These are tested snapshots of Debian Testing to ensure stability and LMDE is binary compatible with Debian, which means you can switch to Debian Testing or Unstable for more frequent and bleeding-edge updates. However, LMDE isn't compatible with Linux Mint, so you can't use Ubuntu PPAs.

LMDE is designed to offer the same look and functionality of Linux Mint and is available as 32-bit and 64-bit Live DVD images with either the Mate or Cinnamon desktops. The distro ships with Firefox, Thunderbird, VLC media player and a plethora of other commonly used apps. Adobe Flash plugin and most other multimedia codecs are installed by default. The software repos and the underlying Deb package system makes software installation easy, thanks to tools like the Synaptic Package Manager.

Genus Ubuntu

Derivatives, they're coming outta the walls.

Ubuntu is, in many respects, the first distro to make a serious effort to bring in new users. The distro brought Linux into the mainstream, played a significant part in changing the notion and misconceptions about Linux and was able to successfully pitch itself as a viable OS alternative to Windows and macOS.

Ubuntu was started by Mark Shuttleworth. He formed Canonical after selling his security firm, Thawte, to VeriSign. Shuttleworth was a huge fan of the Debian project. However, there were many things about Debian that didn't fit in with Shuttleworth's vision of an ideal OS. He therefore invited a dozen or so Debian developers he knew and respected to his flat in London in April 2004 and hashed out the groundwork for the Ubuntu project.

The group decided on a bunch of characteristics for the distro. For one, Ubuntu's packages would be based on those from Debian's unstable branch. However, unlike Debian, Ubuntu was to have a predictable cycle with frequent releases. To put the plan into action, it was decided that Ubuntu would release updated versions every six months and each release would receive free support for nine months. The plan was refined in later years and now every fourth release receives long-term support (LTS) for five years.

The group also decided to give emphasis to localisation and accessibility in order to appeal to users across the world. There was also a consensus on concentrating development efforts on ease of use and user-friendliness of the distro on the desktop. The first release of Ubuntu was in October 2004.

Ubuntu's development is funded by Shuttleworth's Canonical, which is a privately held computer software company. The company also supports development of other Ubuntu-related projects, for instance, Ubuntu's Ubiquity installer is one of the best tools for the job, and one of its distinguishing features is that it gives users the option to install closed source or patented third-party software, such as Fluendo's MP3 codec. Other useful user-centric projects that have tried to change the status quo are the Ubuntu Software Center and the recently discontinued Ubuntu One cloud hosting service.

A number of vendors, such as Dell and Lenovo, offer computers pre-installed with Ubuntu.

TEST BY FIRE

But perhaps no other piece of technology has polarised the Linux community like Ubuntu's Unity desktop interface. The distro first introduced Unity with the Ubuntu Netbook Edition version 10.10. By the time 11.04 rolled off the press, the Netbook Edition had merged into the desktop edition and Unity became the default graphical interface for the Ubuntu distro. However, Shuttleworth has insisted that the Unity desktop plays a crucial role in Ubuntu's multi-device strategy. Unity will help standardise the display on smartphones, tablets, TV and other devices beyond the computer.

Thanks to its malleable nature, the distro has always been very popular with developers who want to create a custom distro for their particular niche. Ubuntu has perhaps seeded more distros than any other, and Ubuntu itself has several officially-supported spins: Kubuntu, Xubuntu, Ubuntu Gnome, Edubuntu and Ubuntu Studio. In addition to the main desktop edition, there's also a server edition that doesn't ship with a graphical desktop.

BEST OF BREED

Trisquel GNU/Linux

Trisquel GNU/Linux goes to great lengths to do justice to its free software tag. Not only does the distro not include any proprietary software, it also strips out all non-free code from the components it inherits from Ubuntu, such as the kernel. Instead of the stock Ubuntu kernel, Trisquel uses the Linux-libre kernel that doesn't include any binary blobs. Thanks to its efforts, the distro has been endorsed by the Free Software Foundation.

There are several variants of the distro, the most common ones are the standard Trisquel release, which is available as a 700MB image with the Gnome desktop, and Trisquel mini, which is designed for older hardware and low-power systems, and uses LXDE, the lightweight desktop.

While the distro doesn't ship with any proprietary codecs, you can watch YouTube videos as it provides HTML5 support as well as Gnash, which is the free alternative to Adobe Flash. Trisquel includes all the usual desktop productivity apps, such as LibreOffice, Evolution, Gwibber, Pidgin and more. These are complemented by an impressive software repository.

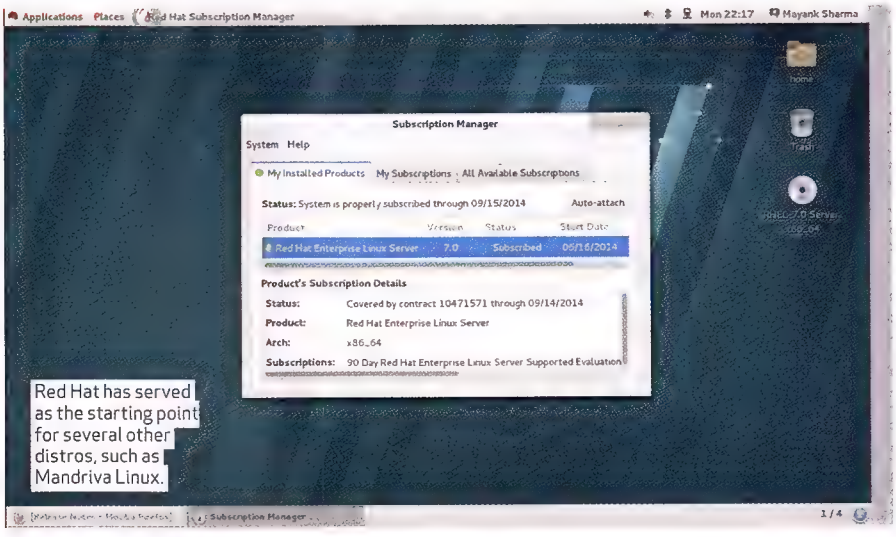
Genus Red Hat

Millinery on a massive scale.

Another distribution that has played a crucial role in shaping Linux's DNA is Red Hat Linux, which was created in 1994 by Marc Ewing. Bob Young and his ACC Corporation bought Ewing's business and created Red Hat Software. The company went public in 1999 and achieved the eighth-biggest first-day gain in the history of Wall Street. It rode on the success of Red Hat Linux to became the first open source billion dollar company.

Over the years, some of the biggest and brightest Linux developers have worked with Red Hat. Soon after it went public, it acquired Michael Tiemann's Cygnus Solutions which had authored the GNU C++ Compiler and worked on the GNU C Compiler and the GNU Debugger.

One of Red Hat's most influential pieces of technology is its RPM packaging format. The file format is now the baseline package format of the Linux Standard Base (LSB), which aims to standardise the software system structure, including the filesystem hierarchy used in the Linux operating system. The LSB is a joint project by several Linux distros managed by the Linux Foundation. Red Hat was also one of the first Linux distros to support Executable and Linkable Format (ELF) instead of the older a.out format. ELF is the standard file format for executables, shared libraries and other files. Red Hat was also the first distro to attempt to unify the look of its Gnome and KDE desktop with the Bluecurve theme, which caused tension with the KDE developers. The distro has won laurels for its easily navigable graphical Anaconda installer.


Applications Places Red Hat Subscription Manager
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Product's Subscription Details
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Product: Red Hat Enterprise Linux Server
Arch: x86_64
Subscriptions: 90 Day Red Hat Enterprise Linux Server Supported Evaluation
Red Hat has served as the starting point for several other distros, such as Mandriva Linux.

LIFE AFTER DEATH

Initially, the Red Hat distro was offered as a free download and the company sustained itself by selling support packages. In 2003, however, Red Hat discontinued the Red Hat Linux distro and it now focuses solely on the Red Hat Enterprise Linux (RHEL) distro for enterprise environments. RHEL supports popular server architectures including x86, x86-64, Itanium, PowerPC and IBM System z. The lifecycle of newer RHEL releases spans 13 years, during which time the users get technical support, software updates, security updates and drivers for new hardware. Red Hat also has a very popular training and certification program called RHCP that's centred around RHEL.

When Red Hat Linux was discontinued, the company handed over development of the free distro to the community. The new project was called Fedora (see following page). The company steers the direction of the Fedora project and does so in order to use Fedora to incubate technologies that will eventually show up in RHEL.

Since the GPL prohibits it from restricting redistribution of RHEL, the company uses strict trademark rules to govern the redistribution. This has led to popular third-party derivatives that are built and redistributed after stripping away non-free components like Red Hat's trademarks. Distros such as CentOS, Scientific Linux and Oracle Linux offer 100% binary compatibility with RHEL.

Red Hat has pioneered the professional open source business model, successfully mixing open source code and community development together with professional quality assurance, and a subscription-based support structure.

CentOS

The CentOS distro has been the premier community-supported enterprise distro based on Red Hat Enterprise Linux (RHEL). The distro is built using the open source SRPMS from the RHEL distro. CentOS is one of the most popular server distros, suitable for all kinds of use cases, from web servers to enterprise desktops, and has been able to pitch itself as an ideal choice for anyone who wants to put together their own server but can't afford the RHEL subscription fees.

CentOS ships with RHEL's Anaconda installer and can run unattended installations across multiple machines thanks to Kickstarter. The installer provides various installation targets such as a web server, database server, and so on.

In January 2014, Red Hat announced that it would start to sponsor a bunch of core CentOS developers to work on the distro full time. However, the developers and Red Hat have both insisted that the project remain independent of RHEL. The sponsorship ensures that all updates will be provided within 24 to 48 hours of upstream releases in RHEL.

Genus Fedora

You've been hit by a smooth distro.

Fedora has been around, in one form or another, since the early 1990s. The distro had its first release in 1995 and the early releases were named Red Hat Commercial Linux. During these early years, the distro was developed exclusively by Red Hat and the community was limited to contributing bug reports and contributing packages included in the distro. This changed in 2003 when the company shuttered Red Hat Linux in support of the Fedora Project and opened it up to contributions from the community.

The aim of Fedora is to provide the latest packages while maintaining a completely free software system. The distro was initially called Fedora Core and was named after one of the two main software repositories – Core and Extras. The Fedora Core repo contained all the basic packages required by the distro as well as other packages distributed with the installation discs, and was maintained exclusively by Red Hat developers. The Fedora Extras repo was introduced with Fedora Core 3. It contained packages maintained by the community and was not distributed with the installation discs. This arrangement continued until version 7 in 2007 when the two repos were merged and the distro was renamed as Fedora.

Fedora's objective is to create a free software distribution with the help of the community. The development of the project is overseen and coordinated by the Fedora Project. It's made up of four Red Hat appointed members and five community elected members. The chairman of the board is appointed by Red Hat. Fedora strives to maintain a roughly six-month release cycle, with two releases each year. Every release is supported until the launch of the next two releases. The cycles are deliberately kept short so that developers can focus on innovation and introducing the latest technologies into the distro.

Fedora was one of the first distros to embrace the Security Enhanced Linux (SELinux) kernel module.

FEATHER IN THE CAP

One way the community contributes is by hosting third-party repositories. In addition to its official software repos, there are several popular third-party software repos that usually contain software not included in the official repos – either because of the current laws of the country (such as multimedia codecs) or because the software doesn't meet Fedora's definition of free software. The Fedora project also produces the Extra Packages for Enterprise Linux (EPEL) repo, which contains packages for RHEL that are created by the community instead of Red Hat.

Apart from the main Fedora release, the project also ships various spins which are special-purpose distros aimed at specific interests, such as gaming, security, design, scientific computing , and so on. These are similar to Debian's Pure Blends and maintained by various Special Interest Groups (SIGs). The OLPC also runs a Fedora-based operating system. Fedora supports the x86 and ARM architectures and has also added support for PowerPC and IBM s390, starting with Fedora 20. Pidora is a Fedora Remix distro optimised for the Raspberry Pi.

Fedora's biggest contribution to the Linux ecosystem is its old command line package manager, YUM (Yellowdog Updater, Modified), which is based on RPM (Red Hat Package Manager). YUM enables automatic updates and dependency resolution, and works with the software repositories to manage the installation, upgrading and removal of packages.

BEST OF BREED

Korora

The Korora distribution started out as a way to ease the installation process of the Gentoo distro, but switched to using the Fedora distro as the base in 2010. The main aim of the distro is to make sure it works right out-of-the box for users.

Korora ships a live DVD, which includes a huge selection of apps that make it suitable for a large number of users and the distro offers five desktop choices – Gnome, KDE, Cinnamon, Xfce and Mate.

While Fedora only ships with open source software, Korora also includes some proprietary software, such as Adobe Flash, which are essential for catering to a wide user base. Korora also allow other software to be easily installed, such as Google Chrome and the proprietary graphics driver for Nvidia cards.

The distro has also eased a gripe for some Fedora users: graphical package management. Korora includes both Apper and Yum Extender, which are two of the most popular front-ends for YUM. Since it's based on Fedora, a new version of Korora is usually a few weeks behind a Fedora release.

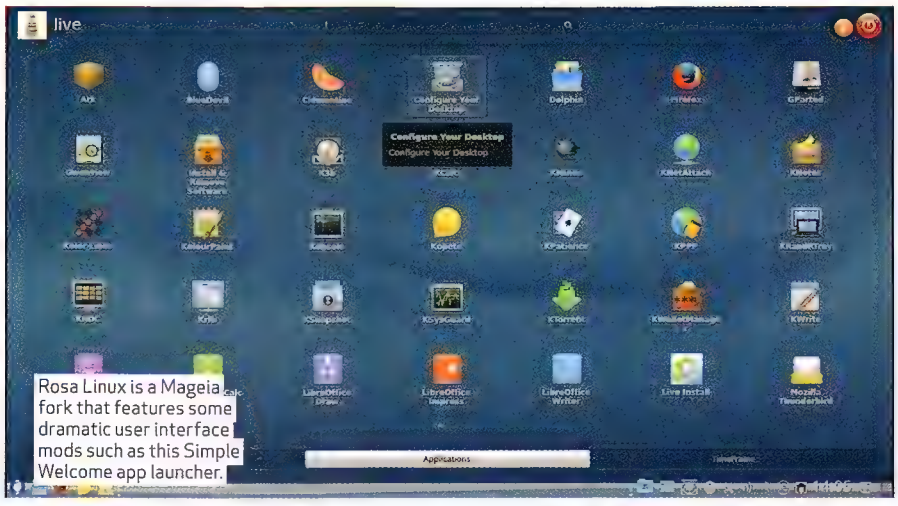
Genus Mandrake

A distro which has a lot to scream about!

Until the release of Mandrake, Linux was generally thought of as a geek's OS. Mandrake was the first distribution that focused on the convenience of the user. The goal was to provide a distro that could be operated by regular computer users. It had features such as the ability to auto-mount CDs without messing around with configuration files, which brought greater convenience to the Linux desktop.

The Mandrake project has perhaps the most convoluted existence for a free software project. Over the years, the project has undergone various name changes, mergers and forks. However, it has spawned many distros and there are several major ones that are still active and can trace their lineage to Mandrake.

The distro has developed a bunch of custom tools, collectively known as drakxtools, to aid its users, who are called Drakes or Draks. One of the most distinguishing components created by the project is its Mandrake Control Center (MCC), which is now a centrepiece of all the derivatives. The MCC provides a single interface to access many different configuration tools. Using the Control Center in text mode is very useful in case of display problems or other serious issues, such as when the graphical server refuses to start. It's also interesting to note that all modules can be run as autonomous apps, without necessarily having to go through the MCC.


live
Rosa Linux is a Mageia fork that features some dramatic user interface mods such as this Simple Welcome app launcher.

ON LIFE SUPPORT

Mandrake Linux was first released in July 1998. It was based on Red Hat Linux 5.1 and featured the inaugural KDE desktop release. After the positive response, lead developer Gaël Duval, along with a bunch of others, created the company MandrakeSoft and, in 2001, the company decided to go public. It faced its first major cash issue in late 2002 and asked its users to bail it out by subscribing to a paid service offering extra benefits, such as early access to releases and special editions. That wasn't enough and the company filed for bankruptcy protection in 2003. However, later that year MandrakeSoft announced its first quarterly profit and, in March 2004, a French court approved its plan to emerge from bankruptcy and return to normal operations.

The company also had to rename its product to Mandrakelinux, after losing a legal battle with the American Hearst Corporation over the Mandrake name and changed its name to Mandriva S.A. after acquiring the Brazilian company Conectiva in 2005. The distro became Mandriva Linux, but in 2006 Mandriva laid off several employees, including co-founder Duval. Amidst the booing, the company continued putting out releases and created a niche for itself in the BRIC region (Brazil, Russia, India and China) as well as France and Italy.

Despite all their efforts, the company struggled to keep its balance sheet in the black. In 2010, Mandriva abandoned development of the community Linux distro to avoid bankruptcy. Immediately afterwards, former Mandriva employees announced Mageia, which has gone on to be one of the most popular Mandrake-derivatives. Mandriva S.A. transferred development to the community-driven Open Mandriva Association. The association's second release called OpenMandriva 2014.0 got a positive review from Duval.

Salix Mageia

Mageia is one of the best-assembled community distros and does a wonderful job of carrying forward the Mandrake legacy. It has an expansive support infrastructure and very good documentation. The distro follows a nine-month release cycle and each is supported for 18 months. Mageia has installable live media as well as install-only DVD images.

Mageia boasts intuitive custom tools for managing various aspects of the distro. One of the best tools is the Mageia Control Center, which has modules for managing software, hardware peripherals and system services. Advanced users can employ it to share internet, set up a VPN and configure network shares. The distro uses the URPMI package management system and ships with three official repos. The Core repo contains open source packages, the Non-free hosts proprietary apps and drivers, and the Tainted repo includes patent-encumbered apps. The distro ships with several desktop environments, and the developers have made sure the user experience is consistent across all of them.

Genus SUSE

Nuga, nuga, nuga, gnu, nui*...

In 1992, Roland Dyroff, Burchard Steinbild, Hubert Mantel and Thomas Fehr founded Software und System Entwicklung (Software and Systems Development). The company started out as a service provider but the founders later decided to have a distro of their own that would cater to the enterprise user. The distro was named SUSE, after the acronym of their company, and it was a stock Slackware release that was translated into German and developed in close collaboration with Slackware's Patrick Volkerding.

For building its very own distribution of Linux, SUSE used the now defunct Jurix distribution. Jurix was created by Florian La Roche, who subsequently joined the SUSE team and began to develop YaST, which is the distro's unique installer and configuration tool. The first SUSE distro that included YaST was released in May 1996 (YaST was rewritten in 1999, and was included for the first time in SUSE Linux 6.3 as an installer only).

Over time, SUSE Linux has incorporated many aspects of Red Hat Linux, such as its well-respected RPM Package Manager. In 1996, the first distribution under the name SUSE Linux was published as SUSE Linux 4.2.

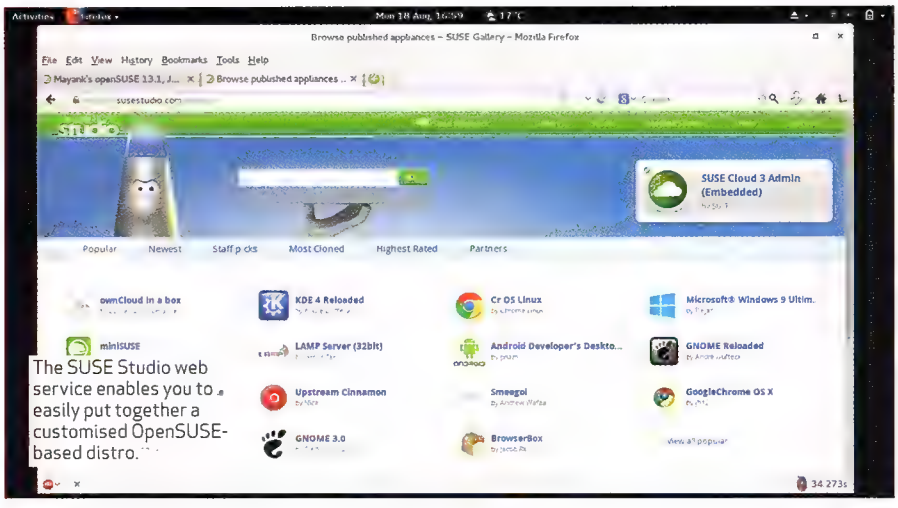
SUSE's focus has always been on bringing open source to enterprise users. It introduced the SUSE Linux Enterprise Server in 2001, and changed the company name to SUSE Linux. After software and services company Novell acquired SUSE Linux in January 2004, the SUSE Linux Professional product was released as a 100% open source project and the OpenSUSE Project was launched, much like Red Hat did with Fedora. The software was always open source and now so was the process which enabled developers and users to test and evolve it.

The initial stable release from the OpenSUSE Project was SUSE Linux 10.0. It included both open source and proprietary applications, as well as retail boxed-set editions. This was also the first release which treated the Gnome desktop environment on a par with SUSE's default KDE desktop. As of version 10.2, the SUSE Linux distribution was officially rechristened as OpenSUSE.

In November 2006, Novell signed an agreement with Microsoft covering improvement of SUSE's inter-operability with Windows, cross-promotion and marketing of both products, and patent cross-licensing. This agreement is considered controversial by some of the FOSS community.

Novell was later acquired by The Attachmate Group in 2011, which then divided Novell and SUSE into two separate subsidiary companies. SUSE offers products and services around SUSE Linux Enterprise – a commercial offering based on OpenSUSE Linux.

SUSE develops multiple products for its enterprise business line. These products target corporate environments and have a longer lifecycle (seven years, extendable to 10), a longer development cycle (two to three years), technical support and certification by independent hardware and software vendors. SUSE Linux Enterprise products are only available for sale. There's also the SUSE Linux Enterprise Desktop (SLED) which is a desktop-oriented operating system designed for corporate environments. In contrast, OpenSUSE does not have separate distributions for servers, desktops and tablets, instead using various installation patterns for different types of installation.



The SUSE Studio web service enables you to easily put together a customised OpenSUSE-based distro.

OpenSUSE

OpenSUSE is one of the best RPM-based distros. It comes in several editions for 32-bit and 64-bit architectures and also has ports for ARM v6, ARM v7, and the 64-bit ARM v8. Once known for its KDE desktop, OpenSUSE now looks good across all the major desktops. Besides KDE and Gnome, the distro also features Mate, Xfce, Enlightenment, and LXDE. You can download the distro either as a smaller live installable image or a install-only DVD image.

One of OpenSUSE's hallmarks is the distro's YaST, which is a setup and configuration utility that enables you to tweak many different aspects of the system. Another popular tool is Snapper, which enables you to revert to a previously created system snapshot.

The distro serves as the base for the SUSE Linux Enterprise products – much as Fedora does for RHEL – and is suitable for all types of users regardless of their skill set. The distro's installer is versatile and offers several customisation options. It can be navigated by new users and includes options to plug the installed system into a corporate directory server.

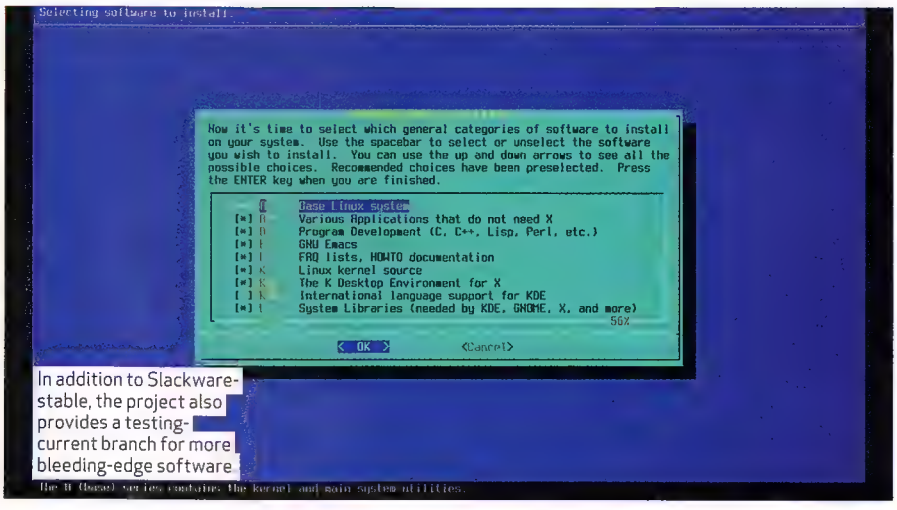
Genus Slackware

The tortoise distro that's outlasted many hares.

Slackware has the honour of being the oldest distro that's still actively maintained. It was created by Patrick Volkerding and had its first beta release in 1993. The project aims to create the most Unix-like Linux distribution. Slackware was originally derived from Softlanding Linux System (SLS), which was the first distro to provide TCP/IP and X Windows System in addition to the Linux kernel and basic utilities. SLS, however, was very buggy and the growing frustration of SLS users prompted Volkerding to release an SLS-like distro in July 1993.

Back then, in addition to being hosted on an anonymous FTP server at Minnesota State University Moorhead, the distro was offered as 24 3.5-inch floppy disks. By the time version 2.1 was released in October 1994, the distro had swelled to 73 disks and Version 3 was released on CD-ROM.

The USP of the distro is that it makes very few changes to upstream packages. Unlike other distros that aim for a particular userbase or a wide variety of users, Slackware doesn't preclude user decisions and doesn't anticipate use cases. The user, therefore, has far greater control on the installed system with Slackware than most other distros.


Selecting software to install
Now it's time to select which general categories of software to install on your system. Use the spacebar to select or unselect the software you wish to install. You can use the up and down arrows to see all the possible choices. Recommended choices have been preselected. Press the ENTER key when you are finished.
Base Linux system
Various Applications that do not need X
Program Development (C, C++, Lisp, Perl, etc.)
GNU Emacs
FAQ lists, HOWTO documentation
Linux kernel source
The K Desktop Environment for X
International language support for KDE
System Libraries (needed by KDE, GNOME, X, and more)
56%
< OK >
<Cancel>

In addition to Slackware-stable, the project also provides a testing-current branch for more bleeding-edge software

CUT SOME SLACK

Unlike other distros, Slackware doesn't provide a graphical installation. It continues to use plain text files and only a small set of shell scripts for configuration and administration. The distro also doesn't provide an advanced graphical package management tool, relying instead on command line tools such as pkgtool, installpkg, upgradepkg, and removepkg. However, these native tools can't resolve dependency issues.

Slackware packages are just plain compressed TAR archives. The package contains the files that form part of the software being installed, as well as additional metadata files for the benefit of the Slackware package manager. As of Slackware 12.2, slackpkg has become the official tool for installing or upgrading packages automatically through a network or over the internet, complementing the traditional package tools suite that only operates locally. Slackpkg also doesn't resolve dependencies between packages. Traditionally, Slackware only offered a 32-bit release, and users had to rely on unofficial ports, such as slamd64 for 64-bit releases. Since Slackware 13, a 64-bit variant is also available and officially supported. In 2002, Stuart Winter started the ARMedslack project, a port of Slackware for ARM. In 2009, Volkerding knighted ARMedslack as an official port of Slackware. With the release of Slackware 14.0, the project has been completely renamed to Slackware ARM.

It might sound surprising, but Slackware is a popular base for many distros. The derivatives include expansive desktop projects, live distros, security distros, and so on.

The Slackware project is also missing some of the common developer-friendly tools. For example, there's no official bug tracking system. Also, there is no official mechanism to become a contributor for Slackware. The final decision on what goes into the distribution is made by Volkerding, Slackware's 'Benevolent Dictator For Life'. In another departure from the norm, Slackware doesn't follow a fixed release schedule, but still aims for one major release a year.

Salix OS

Salix OS is one of the best Slackware-based distros: it's light, nimble and backwards compatible with Slackware. One of its salient features is that it minimises bloat by having only one application per task. The distro supports both 32-bit and 64-bit architectures and is available in five variants for the KDE, Mate, Xfce, Openbox, and Ratpoison desktops.

Salix offers three modes of installation — Full, Basic and Core. The Full option installs everything on the installation image; Basic provides a barebones system with just the graphical desktop, a few essential apps and the Slapt package manager; the Core option will only install a console-based system and is designed for users to custom-build their install.

The Full distro includes all the apps you'd expect on a desktop distro, and is often touted as Slackware with a graphical package manager. Its package manager, Gslapt, resembles the Synaptic package manager and also provides all the same functionality. Multimedia codecs aren't supplied out of the box, but that can be fixed with the distro's custom Codecs Installer.

The marsupials

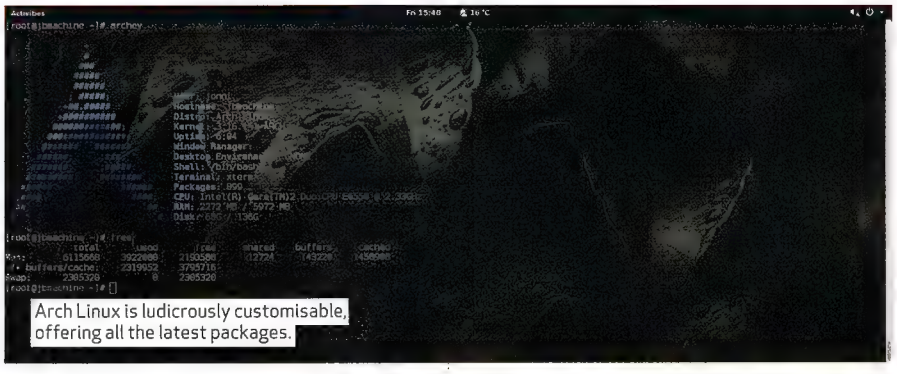
Evolutionary masterpieces and mavericks.

GENTOO LINUX

The goal of the Gentoo project was to create a distro without pre-compiled binaries that was tuned to the hardware on which it was installed. Unlike a binary software distribution, the source code is compiled locally according to the user's preferences and is often optimised. It was initially called Enoch but Gentoo 1.0 was released in 2002.

Gentoo has the distinction of being one of the most configurable distros and appeals to Linux users who want full control of the software that's installed and running on their computer. Gentoo users get to create their system from the ground up: the distro encourages the user to build a Linux kernel tailored to their particular hardware. It allows very fine control of which services are installed and running. Memory usage can be reduced, compared to other distributions, by omitting unnecessary kernel features and services.

This distro is a rolling release and one of its notable features is its package management system called Portage. If you've never used it before, there's a steep learning curve to using Gentoo.



Arch Linux is ludicrously customisable, offering all the latest packages.

Derivatives such as Funtoo can be a good starting point if you're not ready to dive straight in.

ARCH LINUX

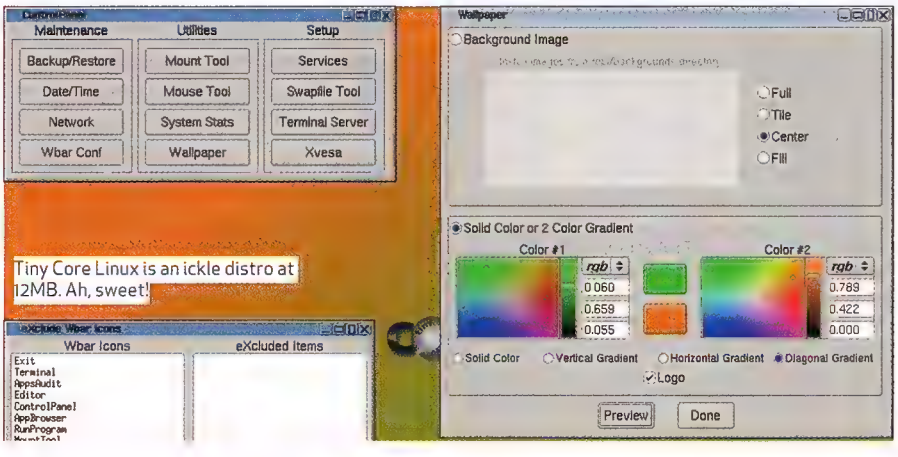
Judd Vinet wanted to create a distro that was inspired by the simplicity of Crux, Slackware and BSD, and thus created Arch Linux in 2002. Arch aims to provide a lightweight foundation on which the user can build according to their needs. In Vinet's words: "Arch is what you make it". A bit like life, really.

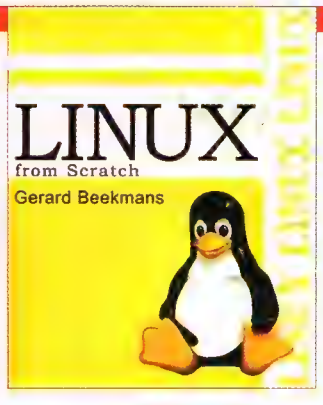
The most impressive feature of the Arch distro is the Pacman package management tool. Arch is a rolling release that can be brought up to date with a single command. Installing Arch Linux is an involved process and, although it is well-documented, it's still better suited for experienced Linux campaigners. However, Manjaro Linux is an Arch derivative that's more user-friendly and has a graphical installer.

TINY CORE LINUX

If you can't invest time creating an Arch or Gentoo installation, try Tiny Core Linux. The distro installs the bare minimum software you need to boot into a very minimal X desktop. From here on, you've complete control and can install apps from online repos or compile them manually.

The distro is a mere 12MB and bundles only a terminal, a text editor and an app launcher on top of the lightweight FLWM window manager. It has a control panel to manage bootup services and configure the launcher, but everything else needs to be pulled in from its manager, including the installer if you want Tiny Core on your hard disk. The distro also has a CorePlus variant, which has additional drivers for wireless cards, a remastering tool and internationalisation support.

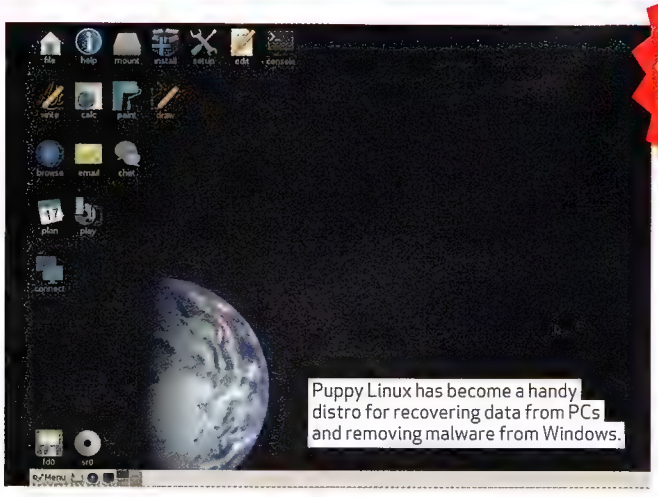




Linux From Scratch

Rather than being a distribution itself, Linux From Scratch – popularly called LFS – is a freely available set of instructions to create your own custom distro from the ground up, entirely from source. The project was started in 1999 when its author, Gerard Beekmans, wanted to learn how a Linux distro works behind the scenes. While building his system from scratch, Beekmans wrote down the steps and released it as a HOWTO (pictured, left) thinking that there would probably be other people who would be interested.

LFS has grown quite a bit from its humble start, transforming from a single HOWTO to a multi-volume book. It has also spawned various sub-projects over time, such as BLFS or Beyond LFS which fleshes out the basic LFS system, and ALFS or Automated LFS, which is designed to help automate the process of creating an LFS system.



Puppy Linux has become a handy distro for recovering data from PCs and removing malware from Windows.

PUPPY LINUX

One of our all-time favourites, Puppy Linux had its initial release in 2003 and the first stable one in 2005. The distro is built from the ground up and its initial goal was to support older hardware that had been rendered useless due to lack of support in other distros.

The real power of the distro lies in its plethora of custom apps. There are custom apps to block website ads and add internet telephony, a podcast grabber, a secure downloader, an audio player, a DVD burning app and more. First-time users might be intimidated by Puppy's installer as it has no automatic partitioner, and fires up Gparted for you to format the disk. But each step in the installer is well-documented within the installer itself.

Packages for Puppy Linux are called pets, and have a .pet extension. You can install packages using its custom Puppy Package Manager tool, and you can configure it to download packages from other Puppy repos. The distro includes tools which can be used to easily churn out variants. Puppy Linux variants are called puplets. Popular puplets are WaryPuppy for supporting older hardware, RacyPuppy for newer hardware, the Slackware-based SlackoPuppy, and PrecisePuppy which is based on the Ubuntu LTS release.

SLITAZ GNU/LINUX

SliTaz stands for Simple Light Incredible Temporary Autonomous Zone and had its first stable release in 2008. The distro is built with home-brewed tools known as cookutils and uses BusyBox for many of its core functions. The distro includes a mixture of the LXDE and OpenBox window manager and is designed to perform on hardware with only 192MB of RAM. The distro weighs under 30MB and uses a mere 80MB of hard disk space.

The distro also has a bunch of custom tools such as the Tazpkg package manager and SliTazPanel for administering all aspects of the distro. SliTaz repos include over 3,000 packages for every popular open source app and it's a common option for powering low-powered machines.

PCLINUXOS

PCLinuxOS began life as a repository of RPM packages for the Mandrake distro in 2000 and became a distro in late 2003 as a branch of Mandrake Linux 9.2.

Although it retains a similar look and feel to Mandriva Linux, and its configuration tool and installer give away its Mandriva lineage, PCLinuxOS has diverged significantly.

The distro has replaced Mandrake's URPMI package management system, opting instead for APT-RPM. This is based on Debian's APT but uses RPM packages, together with the Synaptic package manager. PCLinuxOS is a KDE distro, but also has community spins around the LXDE and Mate desktops.

TOP DESKTOP DISTRO

We're going to tread on that hallowed patch of earth where angels fear to tread (and not because a bushy-bearded Russell Crowe is eyeballing them) and attempt to pick an overall distro winner. This means we had to pick a criteria that allowed for ease of use alongside the ability to build in complexity for specific use cases and, we admit, the result is purely subjective.

Mageia

The community supported distro has everything you want from a modern Linux distribution – an active and vibrant user and developer community, a well-defined support structure, support for multiple desktops and install mechanisms.

OpenSUSE

Coming in at second place, the OpenSUSE distribution loses out because of recent activities of its corporate parent. Also, the distro still focuses on introducing changes that make it fit more snugly on the corporate desktop, rather than home user.

Korora

This is your best bet if you want a RPM-based distribution that works out of the box. However, Korora is still essentially a one-man show and inherits some of the less flattering features of its parent distro, Fedora. ■

System News

Mark Williams wonders if AMD will ever become coordinated enough to fight effectively on two fronts simultaneously.

Rubbing your belly while patting your head is a classic way to try with children to see if they can do two things at once, often to hilarious effect. Since acquiring ATI, AMD has been effectively doing just this – rubbing its belly in designing CPUs while patting its head in designing GPUs.

Unfortunately, AMD can't quite seem to work out how to effectively do both at the same time. It always seems to compete strongly on one front while the other struggles.

When its Bulldozer architecture hit, it was decent but clearly inferior to Intel's CPU offerings. A gap that widened with time. During this period the GPU side of the company seemed to be doing most of the profit-driving heavy lifting, while going toe to toe with Nvidia's best. That was until Nvidia launched the GTX 1080 Ti – a GPU that AMD has is yet to deliver a proper answer to, let alone take it to the the newer RTX 2080 Ti. The cryptocurrency boom kept AMD's GPU sales inflated rather more than they should've been, seemingly making AMD complacent, and now AMD appears to have been caught off guard by the boom's sudden end.

Before the current RTX competition, AMD had launched its newly competitive Zen CPU architecture, taking the fight back to Intel in a seriously big way and initiating the core wars we're seeing at the moment. But in duking it out with Intel on the CPU front, AMD seems to have lost all focus on the GPU front against Nvidia, with Radeon VII being the only new consumer GPU launched by AMD in the one-and-a-half years since RX Vega. And even then, it's simply a consumer version of the enterprise grade Radeon Instinct MI50 that's in the ball park of the GTX 1080 Ti, and is arguably just a tweaked Vega design shrunk down onto a 7nm process. So, nothing really new.

The Radeon VII seems to currently be in very limited supply too, so not many are being made, and with the likes of the Vega 56 and 64 starting to show their age against Nvidia's newest lowest end cards one must wonder how long AMD can go without a GPU range refresh. Thankfully, word on the street is around June (Computex) this year will be when its next-gen Navi GPUs will be announced, alongside the Ryzen 3000 series (and potential new console announcements).

AMD has been in a very unique position in the market since acquiring ATI, in that it's able to make high-end CPUs and GPUs. Something neither Nvidia nor Intel can currently do. It's likely the primary reason why both Microsoft and Sony went with AMD's APU solutions for their respective current generation consoles.

With Intel having now confirmed it will enter the consumer discrete graphics card market in 2020 and having recently claimed several big AMD staff scalps for it's own product development, AMD has around a year or so to start patting it's head competently enough to stand up to Intel's new GPU threat as well as Nvidia's superior RTX line-up whilst rubbing its belly quick enough to maintain its very robust x86 CPU battle with Intel.

With two other competitors in the GPU space, AMD simply cannot afford to lose focus like it currently has if it wants to remain relevant.

SHOP TALK

How popular is AMD's Radeon VII with your customers? Are stocks low due to supply or demand? What percentage of total discrete GPUs you sell are AMD?

John, TI Computers:
"Yes, we did have some interested in the Radeon VII being a multi-purpose card. However, that demand did not last too long. Primarily the performance gap between the Radeon VII and its next GPU down, the RX590 is just too big. Not to mention the complete Nvidia GPU line-ups leaving only limited room for AMD. To date, the majority of our discrete graphics sale is still with Nvidia."

Jaimie, Leader Computers:
"At Leader we saw a heap of hype on the Radeon VII but stock has been almost non-existent, with whatever we can source getting grabbed almost immediately.

Unfortunately, AMD has not had any real market success since the cryptocurrency boom died last year, as the market got flooded with second-hand RX570 and RX580 cards, and the Vega, while excellent, just didn't have the marketing behind it to compete with the NVidia juggernaut. NVidia has the lion's share of the new market, around 80% and possibly higher."

Market Snapshot

A sampling of PC systems available this month.

Mwave IEM Champion 2.0 Gaming PC

$2,299 - TINYURL.COM/APC467-IEM

This is a fun little PC. It's bright, colourful and powerful enough to stop anyone laughing at how small it is.

Packing a 650W power supply, this diminutive system utilises Intel's latest six-core processor and water cools it. Being unlocked, it'll provide some overclocking headroom to explore finding those extra GHz games just love from Intel processors.

Some quick RAM will keep the CPU well fed while it supports the RTX 2070 in dishing out a topnotch 1440p experience, with all the shiny stuff enabled.

The single 1TB SSD is nice, but being a SATA drive it's a missed opportunity when faster NVMe-based options only cost $100 more. The in-built Qi wireless charger on top of the case is a handy touch.

KEY SPECS: CPU: Intel Core i5 9600K; Cooler: Cooler Master 120mm AIO; Motherboard: ASRock Z390 based; Graphics: Nvidia GeForce RTX 2070 8GB; Memory: 16GB T-Force 3000MHz DDR4 RGB; Storage: Samsung 860 QVO 1TB SSD; Power Supply: InWin 650W; Case: InWin A1 Plus.

PLE Computers Home Ryzen APU Force

$784 - TINYURL.COM/APC467-PLE

Initially this system seems OK, and it is, but there are two cheap upgrades that would make a world of difference to it. 4GB of RAM is barely enough for Windows 10. It might be enough if you only intend to lightly browse the web but for an extra $42 at checkout you can get 8GB (2x 4GB) giving your system breathing room and enabling dual channel memory access.

The sole 1TB HDD is capacious but if storage space isn't of much concern, for -$10 the 240GB SSD option at checkout will make this PC an order of magnitude more responsive and snappier.

With the above options totalling just +$32, this'd become a great system capable of even running many indie and esports game titles.

KEY SPECS: CPU: AMD Ryzen 5 2400G; Cooler: OEM; Motherboard: Asus Prime A320M-E; Graphics: Onboard (Vega 11); Memory: GeiL 4GB DDR4 Pristine 2400MHz; Storage: WD Blue 1TB 7200RPM HDD; Power Supply: eVGA GD Series 450W; Case: Deepcool Tesseract.

PC Case Gear Wraith 1060

$1,449 - TINYURL.COM/APC467-PCCG

Intel's current high CPU prices aren't helping this system any, despite having a previous generation CPU installed.

The CPU alone costs $60 more than its closest competitor, the Ryzen 5 2600; then the motherboard is a good $20 more than an AM4 equivalent.

You can probably see where this is going. At the low to mid end of town, Intel is a tough sell.

Compared to this month's TI Computers "Winning" system, this looks like appalling value for money. It costs more, has half the RAM capacity and a slower previous generation graphics card and only a SATA SSD. The RAM speed is nice at least, but that can't save this system. Steer clear of this one, it's poor value.

KEY SPECS: CPU: Intel Core i5 8400; Cooler: OEM; Motherboard: Asus Prime B360M-K; Graphics: Asus GeForce GTX 1060 DC2 Strix Gaming OC 6GB; Memory: Team T-Force Dark 3200MHz 8GB DDR4; Storage: Kingston A400 SSD 240GB, Seagate Barracuda 1TB HDD; Power Supply: be quiet! Pure Power 11 500W; Case: Phanteks Eclipse P300.

TI Computers Winning Gaming PC

$1,325 - TINYURL.COM/APC467-TI

It's surprising how much performance you can get on the cheap these days. This PC is a good example. A 12 threaded CPU and a graphics card capable of fast 1080p game play or even 1440p at 60fps. That's some amazing performance for the price!

Ryzen likes fast memory and while the 16GB of 2400MHz RAM is quite acceptable, 3000MHz+ would've been nicer to see.

The 500W PSU will keep future upgrade paths limited and the 256GB SSD might feel small after a little while, so keep these in mind for future planning.

With Nvidia about to unveil ray-tracing support on the GTX 1660, there's not many reasons to not buy this system!

KEY SPECS: CPU: AMD Ryzen 5 2600; Cooler: OEM; Motherboard: Asus Prime A320M-A; Graphics: Asus Phoenix Geforce GTX1660 OC 6GB; Memory: 16GB Kingston 2400Mhz DDR4; Storage: 256GB M.2 NVMe SSD, 2TB Seagate 7200rpm HDD; Power Supply: Cooler Master 500W; Case: Cooler Master MasterBox Lite 3 Case.

PC blueprints

The *APC* team's picks for a part-by-part perfect PC build to suit your budget.

PARTS LIST

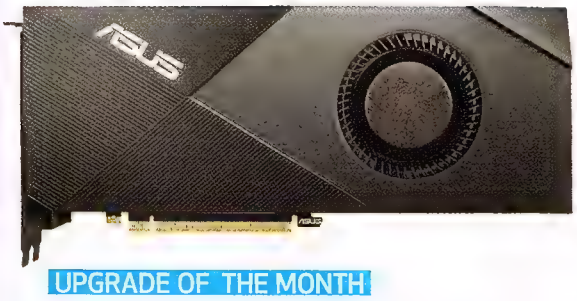
PART		PRICE
CASE	BITFENIX NOVA TG	$75
PSU	450W CORSAIR CX450	$69
MOBO	ASROCK AB350M PRO4 AM4 **NEW**	$135
CPU	AMD RYZEN 5 2600	$259
GPU	ZOTAC GEFORCE GTX 1060 3GB **NEW**	$289
RAM	8GB (2X 4GB) TEAM T-FORCE DARK @ 3,000MHZ	$99
SSD	120GB ADATA ULTIMATE SU650 2.5-INCH SSD	$39
HDD	1TB WESTERN DIGITAL RE3 3.5-INCH HDD	$66
OS	UBUNTU DESKTOP LINUX 18.04 LTS 64-BIT	$0
APPROXIMATE PRICE:		$1,031

Last issue, we managed to shave a few dollars off this build and still end up with a decent budget machine. This month, it's a different story. Price increases big and small have meant that we've seen the overall cost jump up $29, while the underlying performance and capabilities haven't really changed in any notable way. Even hitting this price point, we had to say goodbye to a couple of components. The Asrock motherboard we used last month saw a significant price hike, which forced us to switch to the Asrock B350M Pro4 AM4. Meanwhile, the diminishing stock of GeForce GTX 1060s means that we had to swap out from last month's Gigabyte card to the Zotac, because the former saw a small price increase. That said, with GeForce GTX 1660 (and perhaps 1650s) on the way, these should really help our budget build, because we can't see this trend reversing anytime soon.

PARTS LIST

PART		PRICE
CASE	FRACTAL DESIGN MESHIFY C	$129
PSU	550W CORSAIR CX550M 80+ BRONZE **NEW**	$95
MOBO	ASUS ROG STRIX B450-F GAMING	$209
CPU	AMD RYZEN 7 2700	$369
COOLER	CORSAIR HYDRO H100I PRO 240MM RGB AIO	$169
GPU	EVGA GEFORCE RTX 2060 XC BLACK 6GB **NEW**	$599
RAM	16GB (2X 8GB) TEAM T-FORCE DELTA @ 3,000MHZ	$199
SSD	250GB SAMSUNG 970 EVO M.2 PCIE SSD	$96
HDD	1TB WESTERN DIGITAL RE3 3.5-INCH HDD	$66
OS	WINDOWS 10 HOME 64-BIT OEM	$140
APPROXIMATE PRICE:		$2,071

Overall, we've seen a decent saving on this build this month, because most of the parts used were roughly in the same ballpark as they were last month. The one exception to this was the power supply, with the EVGA SuperNOVA jumping almost 50% compared to what we paid last time. That's why we swapped it out for the Corsair model, which may only be Bronze rated, as opposed to the Gold of the previous unit, but it has a slightly better output of 550w vs the EVGA's 500w, and is semi-modular as well. Elsewhere, we saw a $10 saving on the RAM. The graphics card we used last month jumped up in price, so we replaced it with this tiny EVGA model, which is still available at $599. Despite reports of oversupply of graphics cards for both AMD and Nvidia, pricing on individual models remains volatile, so shop around, and don't be tied to a specific card or brand if you can help it.



UPGRADE OF THE MONTH

Asus Turbo GeForce RTX 2080

$1,099, WWW.ASUS.COM/AU

It's a busy time for graphics cards – new GPUs are coming thick and fast, and the GeForce GTX 1660 Ti is here, too. Trying to pick a winner isn't easy, especially when the case for the RTX family in general has yet to be convincingly made. Even so, when it comes to our Turbo build, there's only one card that really makes sense for the money: the GeForce RTX 2080. While there is more performance to be had from factory overclocked models, it's the stock-clocked cards that make most sense in terms of value for money. So, this Asus card may not fill your case with cool looks, but it delivers where it counts the most – performance.

"Obviously, at this end of the spectrum, that isn't a lot of money, relatively speaking, but as we're not in the realms of factory overclocked cards anyway, there's no real difference to be had."

There are no significant changes to the Turbo build this month, with only the graphics card differing from last month's parts list. That was due to the Asus 2080 being considerably cheaper than last issue's MSI model. That isn't much in the greater scheme of things, but when the same performance is available for less elsewhere, we really don't see the point in sticking with a specific card. In fact, the card we ended up with, the Asus Turbo GeForce RTX 2080, being $100 cheaper, so overall we're making a saving already. Obviously, at this end of the spectrum, that isn't a lot of money, relatively speaking, but as we're not in the realms of factory overclocked cards anyway, there's no real difference to be had.

That saving, though, was eaten up by price increases on other components: The Asrock motherboard is $14 more than last issue, while the NZXT H700i case saw a big $89 jump. These increases were offset slightly by a $20 reduction in the price of the memory kit we use, although given the general sensitivity to RAM, this seems like a reasonable price to pay. Samsung is chargeing even less for its 512GB 970 Pro SSD, saving us $20. Overall, this machine is $40 cheaper than last month, for exactly the same performance. Not much of a saving, but welcome all the same. And until we're hit with some new architectures from Intel and/or AMD, this is still the best overall solution for serious work in our minds.

PARTS LIST

PART		PRICE
CASE	NZXT H700I	$259
PSU	CORSAIR RM750X WHITE 750W GOLD CERTIFIED	$199
MOBO	ASROCK X399 PHANTOM GAMING 6	$299
CPU	AMD THREADRIPPER 2950X	$1,415
COOLER	NOCTUA NH-U14S TR4-SP3 AIR TOWER	$105
GPU	ASUS TURBO GEFORCE RTX 2080 **NEW**	$1,099
RAM	32GB (4X 8GB) TEAM T-FORCE DARK DDR4 @ 3,200MHZ	$379
SSD	512GB SAMSUNG 970 PRO M.2 NVME	$219
HDD	2X 2TB SEAGATE BARRACUDA ST2000DM008	$89
OS	WINDOWS 10 HOME 64-BIT OEM	$140
APPROXIMATE PRICE		$4,203

A Trip Down 2080 Lane

A special request for an RTX 2080 system to star in a commercial video shoot.

Another month, another request from some department or another within APC's parent company. Our publishing house is a big business, and a lot of us work across multiple platforms and multiple brands, either helping each other out just because we can (we flattened two Xbox hard drives today for the IT team, for example), or on a freelance basis.

This time, however, the request came from the video production guys. These folk do some really good work in the more "commercialised" area of the business, filming ads and pitching creative ideas to a whole plethora of big-dollar names across the world. They've requested help from us in the past, and lo and behold, here we are again, with another system build for them.

The brief was simple: Build a system featuring an Nvidia RTX 2080 that the video team could use to showcase some world-exclusive gameplay, aka *Metro Exodus*, running on that wee ray-tracing beastie from the generation Nvidia likes to call current. There wasn't a whole lot of instruction on how or what to build, only that the case would need to have a transparent side panel, and feature some RGB lighting/fans, because the visuals were very important to the piece, or so we were told.

So, we cracked out the contacts book, and with the hardware we already had, reached out to Asus and Nvidia, and set to work.

"Build a system featuring an Nvidia RTX 2080 that the video team could use to showcase some world-exclusive gameplay, aka Metro Exodus, running on that wee ray-tracing beastie from the generation Nvidia likes to call current."

FILM-SET READY

We know it sounds like a rather glamorous affair, but it's not really that unusual for us to receive requests like this. After all, there are very few people in the company who know as much about system building as we do. Because of that, it means we typically know what they're after, more so than they do, even with such a limited brief. For instance, here we also thought it might be used for capturing video, so had video editing in mind from the start.

We also knew that we needed a card that was obviously an RTX 2080, so any AIB partner or aftermarket GPU was off the table. We had to request in a second Founders Edition from Nvidia for the job.

Once that was done, the next step was "RGBing" it up. Asus was our first port of call – we reached out to the team, and they provided us with the motherboard, screen, peripherals and, naturally, the Asus ROG Aura Terminal kit, which comes with two addressable LED lighting strips that we can stick here, there and everywhere.

We also threw in a Core i9-9900K (because, gaming), an Asus ROG Ryujin 360mm cooler, complete with Noctua NF-F12 Chromax fans, and 32GB (4x 8GB) of HyperX Predator RGB to sate the video team's desire for that frustrating frippery the industry seems so taken with.

PARTS LIST

PART		STREET PRICE
CASE	PHANTEKS ECLIPSE P600S	$229
MOTHERBOARD	ASUS ROG STRIX Z390-E GAMING	$399
CPU	INTEL CORE I9-9900K	$899
CPU COOLER	ASUS RYUJIN 360	$399
GPU	NVIDIA GEFORCE RTX 2080 FOUNDERS EDITION	$1,299
MEMORY	32GB (4X 8GB) KINGSTON HYPERX PREDATOR RGB @ 3200HMZ	$458
PSU	750W CORSAIR RM750X WHITE	$199
STORAGE 1	500GB SAMSUNG 960 EVO	$239
STORAGE 2	N/A	$0
OS	WINDOWS 10 HOME 64-BIT	$140
TOTAL		$4,261

1 AIR FILTRATION

Another Phanteks case, another intuitive design feature. Welcome, ladies and gents, to the removable roof and front panels. These two beauties come lined with sound-dampening material as standard, and stay in position via the power of magnets and notches, top and front. If you're after a quiet system, keep the panels in place, and the fans will still draw air in from the side, top, and back vents. Need a little more cooling during those hot summers? Then remove them both, allowing the fabric mesh and filter-covered fans to make the most of that lovely fresh air.

2 HADOOOUKEN

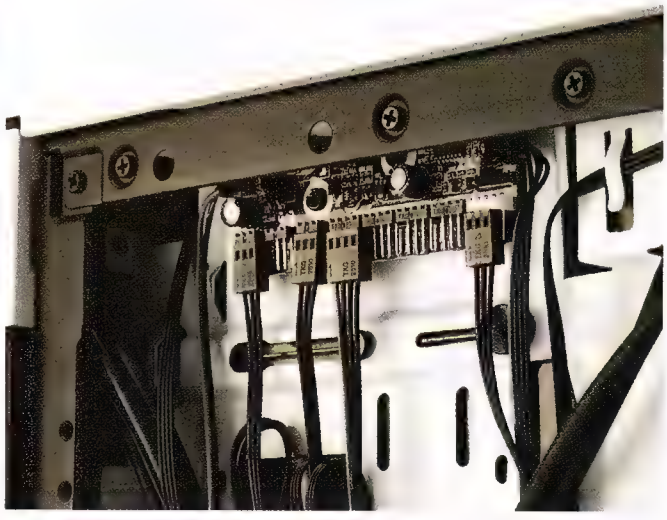
Every time we see the word "Ryujin", that's where our mind goes. However, this all-in-one liquid cooler is a little more complicated than first meets the eye. It looks slick and clean, for sure, but underneath that magnetically attached two-way mirror lies a deceptively annoying CPU block. In short, you can only mount it to the motherboard one way, with the tubing to the right. If you don't, your cover (and subsequent OLED display hidden underneath) will be at the wrong angle, and there's no way of either flipping the screen display or rotating the magnetic clip-on cover.

3 RG... NO

She may have the same innards, but the Eclipse P600S definitely isn't the Evolv X, and underneath this sultry PSU cover, there is no bank of RGB LEDs ready to illuminate the inside of the case. There's a certain irony to that, really, given the brief, but we actually think the Eclipse P600S looks good enough without it. Couple that with the clean black line going across in the white model, in conjunction with our favourite white PSU from Corsair, and it all comes together quite nicely. If only we'd had enough time to request in one of those lovely vertical GPU brackets...

4 REAR I/O PLATES FOR DAYS

Nothing says "satisfying" quite like a built-in rear I/O plate. You know, if this isn't a new standard going forward across the majority of premium chipset motherboards, we're not interested. Seriously, it's just so nice not to need to remember it – simply line up your motherboard, secure it down, and watch as the plate slots safely into the back, with no harm and no foul. One thing we did wish is that there were a few more USB ports on the back of this, but aside from that, the Strix Z390-E is a fairly solid board. Also, from this angle, you can see the included space up top for an additional ITX system, if you so desire – maybe one for the significant other?



5 LED COMMAND UNITS

"Where is the horse and the rider? Where is the horn that was blowing? They have passed like rain on the mountains. Like wind in the meadow. The days have gone down in the West. Behind the hills, into shadow. How did it come to this?" We feel that's an apt enough quote to place here. But seriously, here we have Asus's RGB Aura Sync unit, a nifty little device into which you can plug multiple RGB LED things, so you can RGB your RGB more, or something. Oh, and run up your electricity bill, too. That said, it does work rather well, annoyingly.

6 OUR BIGGEST FANS

Now, this is something we can get behind: integrated fan controllers. Here we can spy a somewhat primitive but exceptional piece of hardware – Phanteks's own integrated fan controller. It supports up to seven fans in total, PWM or standard three-pin, is powered by a SATA header, and plugs in directly to a PWM port on the motherboard, regulating all of the case fans to a single speed. Although not quite as sophisticated as some other fan-controlling options, it's nonetheless a nice feature to have on a chassis at this price point, and one that works well. No fuss, just plug and play.

1 Phanteks's sliding cable covers work well here (better than cable grommets), and are easy to configure. However, they can be tricky if you suffer from OCD.

2 Our Corsair RM750X is getting a little dated now, and the cable's a bit grubby — a burden with an overly used white power supply.

3 This case is exceptionally roomy. There are up to four 3.5-inch hard drive mounting points down under the PSU cover, and a further three 2.5-inch hard drive mounting points on the rear of the mobo tray.

The best-laid Plans of Mice and Men

There you have it folks: a clean, crisp, RGB-equipped build. What you didn't see was the effort we went to getting in a few extra bits and pieces for the shoot. We had a week to get the parts in, build it, and get it ready for filming, which we managed, including peripherals, and a huge 34-inch screen. So, did it all come together? No. The video team reached out to the client who did a U-turn on the decision to run the article. It's a shame when all that work goes to waste.

That said, it did give us the opportunity to take a look at a few new pieces. Building a relatively budget rig — well, budget for an RTX 2080 build — was insightful on a performance basis. Plus, building in the Eclipse P600S wasn't due to be on our agenda for some time, so it also gave us the chance to take a good look at the chassis.

And, boy, what a chassis. It's beautiful to work with. Like most Phanteks cases, it's spacious, packed with a ton of accessories, and supports some seriously nifty features, which we have no doubt are going to make it into the next generation of cases from its competitors, too.

Is the build any good, though? Well, yeah. Once we'd got past the conflicting drivers and chipsets (full reinstall), it performed like a beast, and we got some solid numbers out of it. Say what you want about Nvidia's RTX lineup, but on a pure brute-force level, it performs exceptionally well. It's just a bit harder to stomach the price over last gen.

What would we change? The big one is the cooler — the OLED in the middle isn't exactly classy. The ones on Asus's motherboards are far sleeker, and the fact that this one just has a rotating ROG logo on it as standard felt a bit cheap, as did the majority of the unit. Coupled with the phenomenal price tag, it starts to sound like a bad deal.

We'd also probably change the PSU. Our Corsair RM750 is still working diligently, but it's getting old now, and those cables aren't quite as white as they once were, that's for sure.

On the whole, performance is impressive. At 1440p, the RTX 2080 decimates our zero-point in the gaming tests (although price-wise, it sits between the 1440p and the 4K build perfectly). But with 119fps in *Rise of the Tomb Raider*, and 60fps-plus in everything else, perhaps it's time we retire the old GTX 1080 zero-point, and replace it with something a bit different? ■

BENCHMARK RESULTS

	APC LABS TEST PC	THIS SYSTEM
CINEBENCH R15 MULTI (INDEX)	959	1,732 (81%)
CRYSTALDISK QD32 SEQUENTIAL READ (MB/S)	3,422	2,687 (-21%)
CRYSTALDISK QD32 SEQUENTIAL WRITE (MB/S)	1,706	1,745 (2%)
RISE OF THE TOMB RAIDER (FPS)	95	119 (25%)
TOTAL WAR: WARHAMMER II (FPS)	55	73 (33%)
TOM CLANCY'S GHOST RECON WILDLANDS (FPS)	48	59 (23%)
3DMARK: FIRE STRIKE (INDEX)	9,128	12,049 (32%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our zero-point consists of an Intel Core i5-8400, 16GB (2x 8GB) of Corsair Vengeance LPX @ 2,666MT/s, an MSI GeForce GTX 1080 Armor, and a 500GB Samsung 960 Evo M.2 PCIe SSD. All tests were performed at 1440p at the highest graphical profile.

how to

» QUICK TIPS

Experts solve your computing problems

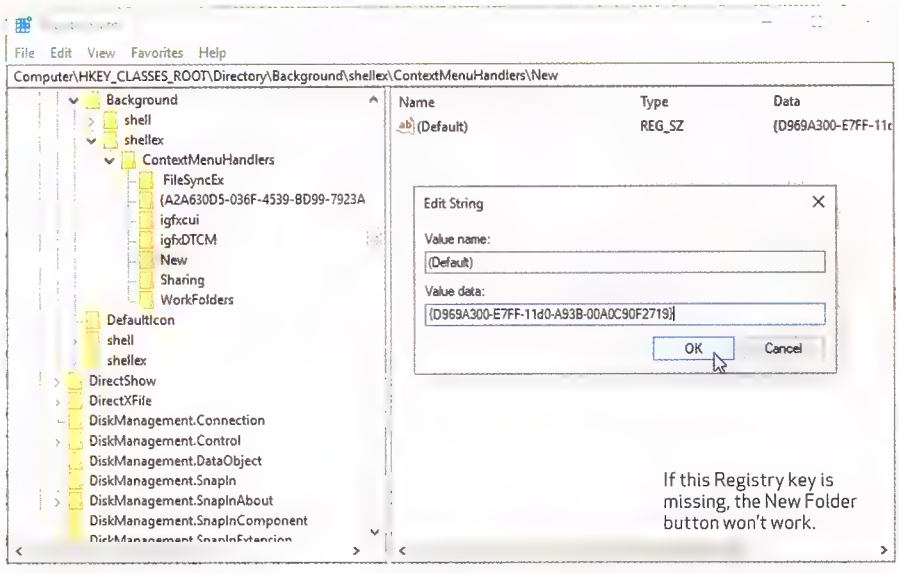
APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

SECURITY

LASTPASS ALTERNATIVE?

I moved away from Firefox to Google Chrome for the simple reason that the LastPass extension on the former is awful. I've now decided to move back, but I see the extension is as rubbish as ever. Rather than ditch Firefox, I've decided to get rid of LastPass instead. Can you recommend a good alternative?
Harriet Young

I recently ditched LastPass for the same reason, Harriet. I've chosen BitWarden (**https://bitwarden.com**) because it's open source, uses end-to-end encryption, supports two-factor authentication and is available across all major platforms, including mobile devices and browsers. The Firefox extension is massively superior to LastPass's half-hearted effort, with easy buttons for copying usernames and passwords when they're not automatically filled and the ability to convert the pop-up dialog into a floating window for easier access. There's also a sidebar feature, too. Transferring passwords and forms from LastPass to BitWarden is easy – log into your BitWarden account through the browser (**https://vault.bitwarden.com**), then select Tools > Import Data. Select 'LastPass (csv)' as your import file format, then use the LastPass extension to export your passwords (choose More Options > Advanced > Export > LastPass CSV File). Your data will be pasted into a new browser tab – select it all, press Ctrl + C then switch to your BitWarden Vault and paste it into the box provided before clicking Import Data. Once that's done, repeat the process for any form fills. Once you're happy that BitWarden is working to your satisfaction you can then remove the LastPass apps and finally delete your account at LastPass.com.
Nick Peers



If this Registry key is missing, the New Folder button won't work.

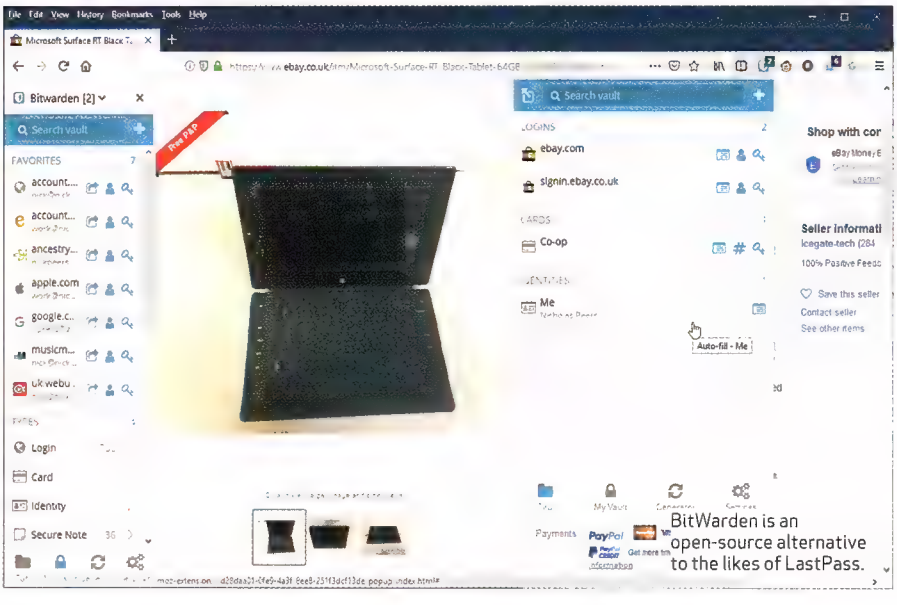
WINDOWS

NEW FOLDER BUTTONS STILL DOESN'T WORK

I tried to follow your advice last issue on fixing my inability to create new folders in File Explorer (File Explorer's Glitchy Behaviour, issue 466), but the problem persists. Is there another avenue that I can pursue?
Dave Carlile

Another possible reason for the New Folder button ceasing to function is a missing or corrupt Registry entry. We instructed Dave to open the Registry Editor (press Win-R, type regedit and hit Enter) and browse to Computer\HKEY_CLASSES_ROOT\Directory\Background\shellex\ContextMenuHandlers. There should be a New key here, and selecting this will reveal a single value – (Default) – of {D969A300-E7FF-11d0-A93B-00A0C90F2719}.

Dave revealed there was no New key present, so he needs to recreate this (right-click on the ContextMenuHandlers key and choose New > Key), then double-click the (Default) value that's created and



BitWarden is an open-source alternative to the likes of LastPass.

change it to the long string listed above. Once done, the feature should work once again.
Rob Mead-Green

NETWORKING
DAISY-CHAIN WI-FI EXTENDERS

I've been tasked with installing a broadband connection to two separate important buildings. I'm looking to extend the Wi-Fi signal from the open-plan building out into the hall at the opposite end from where the modem will be sited. Wired isn't an option, so I'm looking to try and extend the wireless network's range using a Wi-Fi extender.
Sean Granger

Ordinarily this would seem to be the perfect environment for a HomePlug/Powerline setup, using the building's electrical wiring to distribute a strong signal to wherever it's needed – you'd need one plug for the modem, plus additional plugs for whichever Wi-Fi access points you wanted to add. Choose an option like TP-Link's TL-WPA7510 kit, which combines a Powerline adapter with a Wi-Fi extender. The setup here – with each building on separate circuits – meant that this was a non-starter. That said, Sean could purchase the TL-WPA7510 kit for the main building only – this would ensure the wireless signal was at its maximum at the end closest to the hall, with a Wi-Fi extender installed in the hall. It's then a case of hoping the distance between the buildings – plus the thickness of any walls – isn't too great to stop the signal from reaching its destination.
Nick Peers

BROWSER
STOP CORTANA FROM USING MICROSOFT EDGE

It's bad enough that Cortana only works with Microsoft's own Bing engine, but why does clicking a web search in it always open Edge? Is there a way to circumvent this behaviour?
Gerry Anders

There's no setting in Windows that can force Cortana to use any browser other than Edge, but you can use a free tool called EdgeDeflector, which diverts such calls to your browser. Here's how:

Visit **github.com/da2x/EdgeDeflector/releases** and click 'EdgeDeflector_install.exe' to download the app installer. Once saved to your Downloads folder, double-click it to launch the setup utility. Click 'Yes' > Install.

When the setup utility has finished a pop-up will appear. Make sure you select EdgeDeflector as shown and that 'Always use this app' is ticked before clicking OK. If the dialog disappears before you click OK, simply re-run the setup utility.

Any link that Windows attempts to force open in Edge should now be diverted back to your default web browser. You can test this by performing a search in the Cortana window and clicking a search result – it should now open in your normal browser.

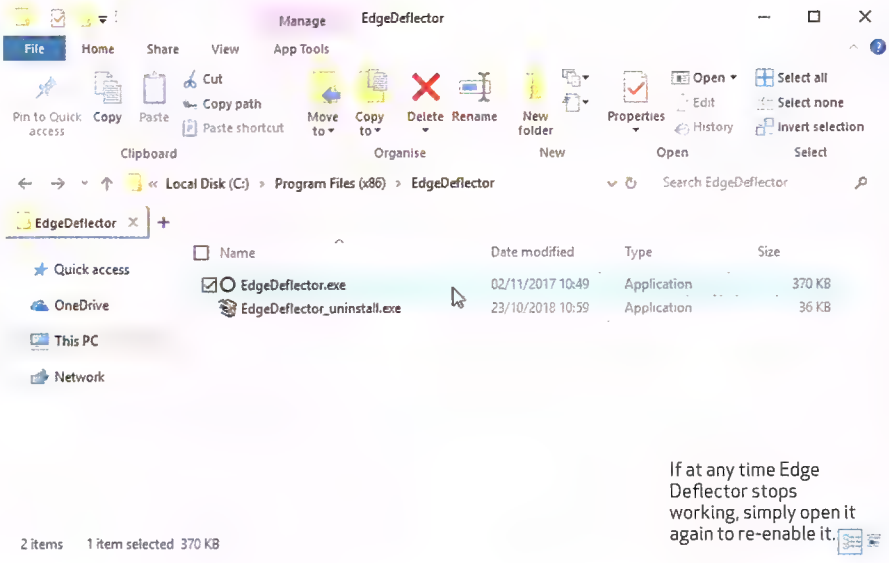
If – as is likely after a major feature update, for example – links start opening in Edge again, browse to C:\Program Files (x86)\EdgeDeflector where you'll find the program resides. Double-click it to restore the link back to your browser.
Rob Mead-Green

Powerline adapters offer a clever way to boost your signal.

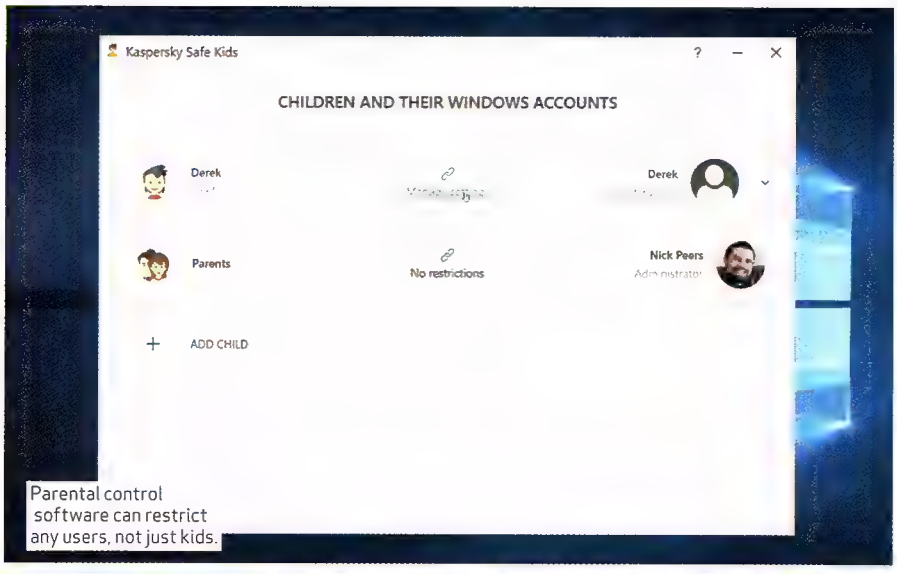
> "It's then a case of hoping the distance between the buildings – plus the thickness of any walls – isn't too great to stop the signal from reaching its destination."

SECURITY
LOCKED-DOWN LAPTOP

I'm looking for a new laptop to help run the membership of our community pool. It doesn't need to do anything major, plus I would like to know how to lock down the laptop to prevent unauthorised program installations as well as blocking the use of certain applications such as games. The user should only need to move pictures from a camera SD card to the appropriate folder on the laptop each day.
Gerald Gibson

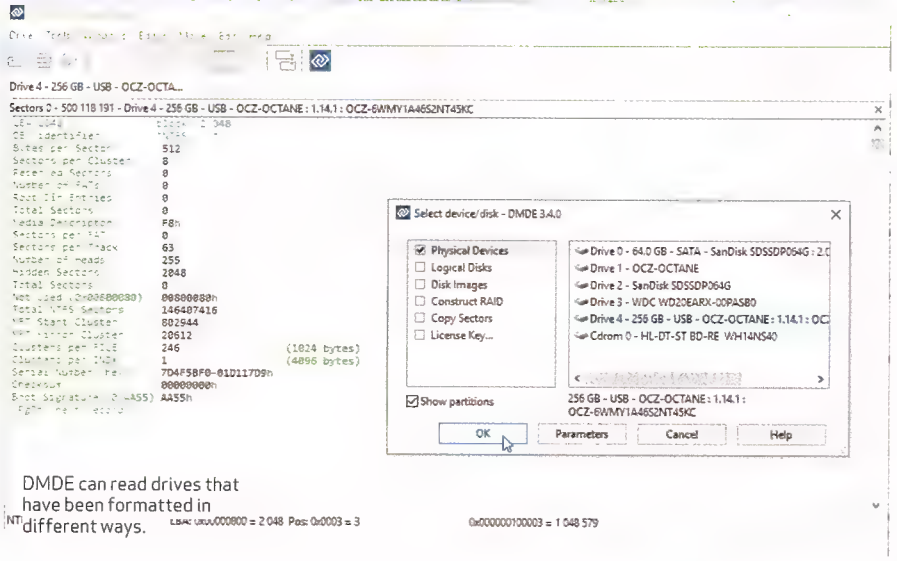


If at any time Edge Deflector stops working, simply open it again to re-enable it.



Parental control software can restrict any users, not just kids.

"Assuming you can't remove the apps and games you don't want them to use, you'll need to investigate some form of parental control tool to restrict access to specific programs."


Drive 4 - 256 GB - USB - OCZ-OCTA...
Sectors 0 - 500 118 191 - Drive 4 - 256 GB - USB - OCZ-OCTANE : 1.14.1 : OCZ-6WMY1A4652NT45KC
Bytes per Sector 512
Sectors per Cluster 8
Media Descriptor F8h
Sectors per Track 63
Number of Heads 255
Hidden Sectors 2048
Total Sectors 0
Total NTFS Sectors 146407416
MFT Start Cluster 802944
MFT Mirror Cluster 20512
Clusters per File 246 (1024 bytes)
Clusters per INDX 1 (4096 bytes)
Serial Number 7D4F5BF0-01D117D9h
Checksum 00000000h
Select device/disk - DMDE 3.4.0
Physical Devices
Logical Disks
Disk Images
Construct RAID
Copy Sectors
License Key...
Drive 0 - 64.0 GB - SATA - SanDisk SDSSDP064G - 2.0
Drive 1 - OCZ-OCTANE
Drive 2 - SanDisk SDSSDP064G
Drive 3 - WDC WD20EARX-00PASB0
Drive 4 - 256 GB - USB - OCZ-OCTANE : 1.14.1 : OCZ
Cdrom 0 - HL-DT-ST BD-RE WH14NS40
Show partitions
256 GB - USB - OCZ-OCTANE : 1.14.1 : OCZ-6WMY1A4652NT45KC
OK
Parameters
Cancel
Help

DMDE can read drives that have been formatted in different ways.

Any basic laptop will provide you with everything you need – just make sure it has a built-in SD card slot to simplify the process of transferring the photos across. Choose a model with an SSD for better performance, and make sure it runs the full version of Windows 10, not the cut-down 'S' version.

Your security concerns can be addressed using Windows' built-in tools. Set up the laptop with yourself as the main administrator user, password-protected. Then create a second user account for others to use – this needs to be a standard user, which will prevent the person(s) using the account from installing any apps without your express permission. Assuming you can't remove the apps and games you don't want them to use, you'll need to investigate some form of parental control tool to restrict access to specific programs. Check to see if your security software offers this, or try Kaspersky Safe Kids (**www.kaspersky.com.au/safe-kids**) – the free version enables you to block access to whichever apps you specify.

Catherine Ellis

HARDWARE
EXTERNAL DRIVE ISN'T RECOGNISED

My Bipra USB hard drive no longer connects to my PC. It used to connect fine with just a data cable, then required separate data and power cables, and now while Windows recognises a USB device has been attached, it informs me it's unrecognised or faulty. Occasionally it'll work, and Windows reports zero disk errors.

Christopher Clayton

It could be the drive that is failing, its enclosure, or the cables. You need to check its SMART status using a tool like HDDScan (**hddscan.com**). If you have access to another enclosure or SATA-to-USB adapter, you could remove the drive from its Bipra enclosure and attempt to connect it through that. If it works, the problem is with the enclosure – replace it with another. If the drive shows up, but while passing SMART tests appears to be unreadable in Windows, it could have been set up in a proprietary way. In this case, you'll need to repartition and format the drive; use the free DMDE data-recovery tool (**https://dmde.com/**) first to recover data from the drive.

Nick Peers

MESSAGING
WHATSAPP ALTERNATIVE

Can you recommend an alternative to WhatsApp that can be used across phones, tablets and PCs without being tied to a single phone? My friends want to set up a closed group and are happy to install an app for that.

David Parker

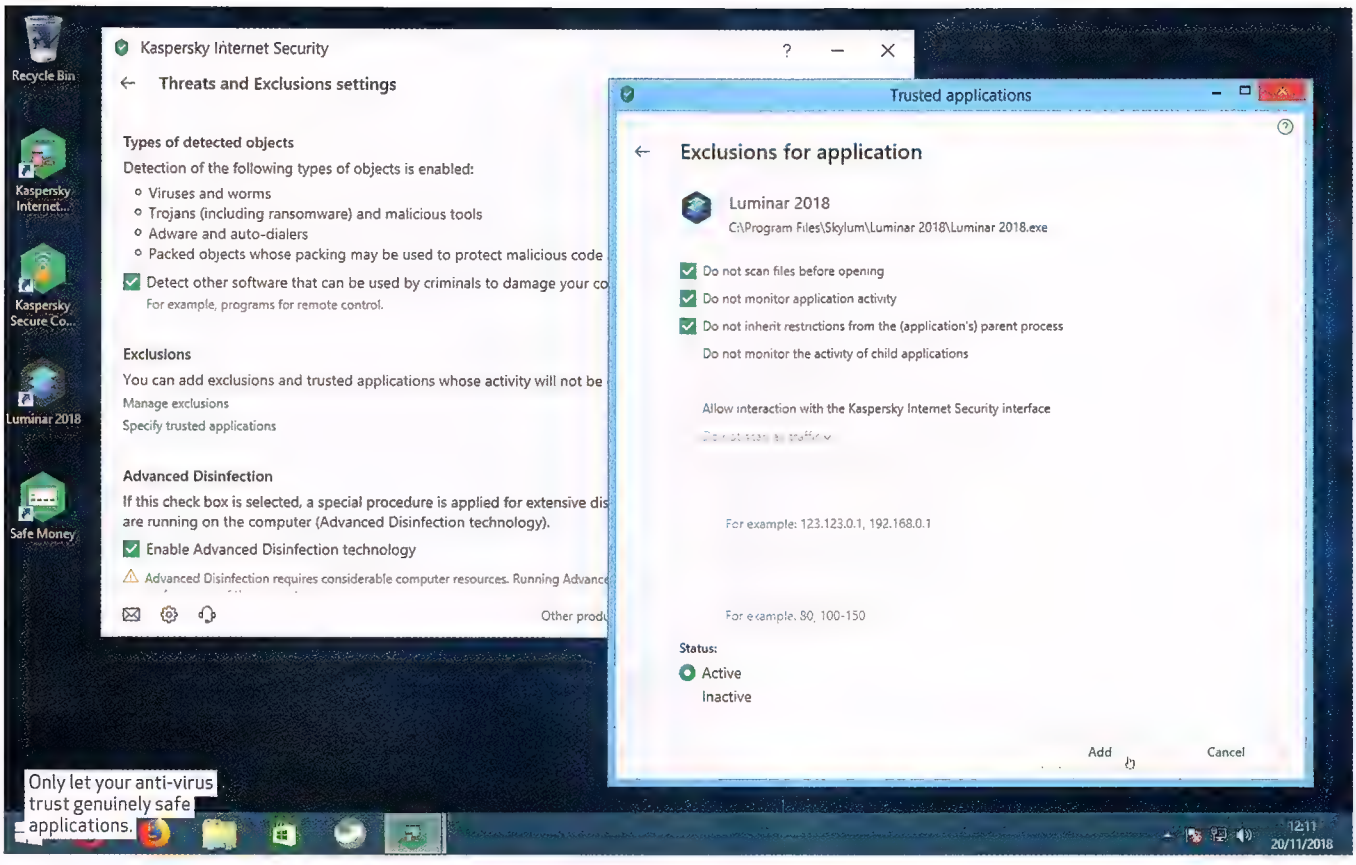
Check out the highly regarded app Signal (**signal.org**), which works along similar lines to WhatsApp in that it's linked to a phone and can be configured for group conversations. Unlike WhatsApp, once set up on your phone, you can install the desktop client on your PC and link it to your phone, enabling you to view and send messages from your computer.

Mayank Sharma

SECURITY
KASPERSKY CRIPPLES PHOTO EDITOR

I'm using Luminar 2018 photo editor. After upgrading it, the program has lost several functions. Luminar's support team blames my antivirus, Kaspersky, and tells me I have to stop it blocking the program. Is there a way to do this?

Doug Curtis


Kaspersky Internet Security
Threats and Exclusions settings
Types of detected objects
Detection of the following types of objects is enabled:
Viruses and worms
Trojans (including ransomware) and malicious tools
Adware and auto-dialers
Packed objects whose packing may be used to protect malicious code
Detect other software that can be used by criminals to damage your co
For example, programs for remote control.
Exclusions
You can add exclusions and trusted applications whose activity will not be
Manage exclusions
Specify trusted applications
Advanced Disinfection
If this check box is selected, a special procedure is applied for extensive dis
are running on the computer (Advanced Disinfection technology).
Enable Advanced Disinfection technology
Trusted applications
Exclusions for application
Luminar 2018
C:\Program Files\Skylum\Luminar 2018\Luminar 2018.exe
Do not scan files before opening
Do not monitor application activity
Do not inherit restrictions from the (application's) parent process
Do not monitor the activity of child applications
Allow interaction with the Kaspersky Internet Security interface
For example: 123.123.0.1, 192.168.0.1
For example: 80, 100-150
Status:
Active
Inactive
Add
Cancel
Only let your anti-virus trust genuinely safe applications.

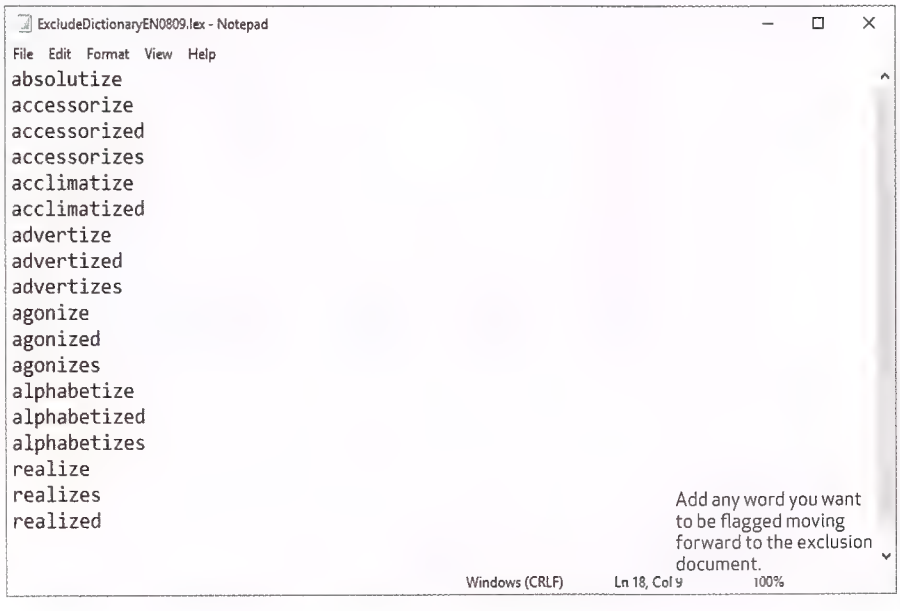
We're not big fans of companies blaming security apps for blocking their programs – we'd prefer them to identify the issue and release a patch, so users aren't forced to compromise their security. Nevertheless, security apps are smart enough to enable you to mark applications as trusted, so their features aren't blocked. In Kaspersky, open its Settings and navigate to Additional > 'Threats and Exclusions'. Click 'Specify trusted applications', then click Add. Scroll down the list to Luminar, select it and click Add. If Kaspersky is the culprit, you should find Luminar now works correctly; if not, get back in touch with its support team and ask for further advice.

Rob Mead-Green

OFFICE
ADD MISSPELLINGS TO WORD'S EXCLUSION DICTIONARY

I've noticed that Word's Australian English dictionary doesn't flag words ending in 'ze' as incorrect – I prefer 'se', as in 'realise'. How do I rectify this?

Karen Dervish



Both 'ze' and 'se' spellings are considered correct in international English, but if you're sticklers for the 'se' spelling like us, you'll need a special exclusion dictionary to ensure they're always flagged.

Press Win-R to open the Run dialog, then type `%appdata%\Microsoft\UProof` and click OK to locate the folder containing the exclusion dictionaries. The one you need for the AU English dictionary is ExcludeDictionaryEN0C09.lex.

Right-click on ExcludeDictionaryEN0C09.lex and choose 'Open with'. Click 'More apps' and scroll down until you locate your regular text editor – typically Notepad. Select it, untick 'Always open with', then click OK to open the exclusion dictionary.

A blank file will open. Now simply type, or copy and paste in, the words that you wish to add to your exclusion dictionary, making sure each one is on a separate line. Choose File > Save to periodically update the file.

When you next open Word and your troublesome document, you should now find that all the words in the exclusion dictionary have now been flagged – right-click and you should find the correct 'se' spelling is offered as an alternative.

Rob Mead-Green

Make photos look fantastic

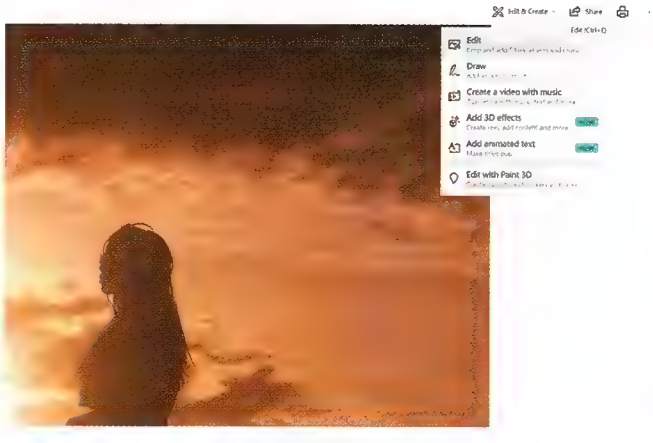
Ian Evenden explains how a simple crop and enhance is one of the best things you can do for your photographs.

Whether you shoot photos on your phone or a DSLR, not every snap is going to turn out to be a masterpiece. So many things can get in the way of true artistic expression, be it the lighting refusing to come from the direction you want it to, or inconvenient geography making it impossible to stand exactly where you want.

These are the sorts of thing image-editing apps can help you with. Tweaks to lighting, slight changes to the composition, and even small alterations to the colours in an image can make a huge difference to the way an image is perceived. It can make the difference between a photo that's looked at in detail or one that's just passed by.

Here are some of the simplest and most effective edits you can make, and you don't need any tools outside of those that ship with Windows 10 to do them.

Crop and enhance your photos!

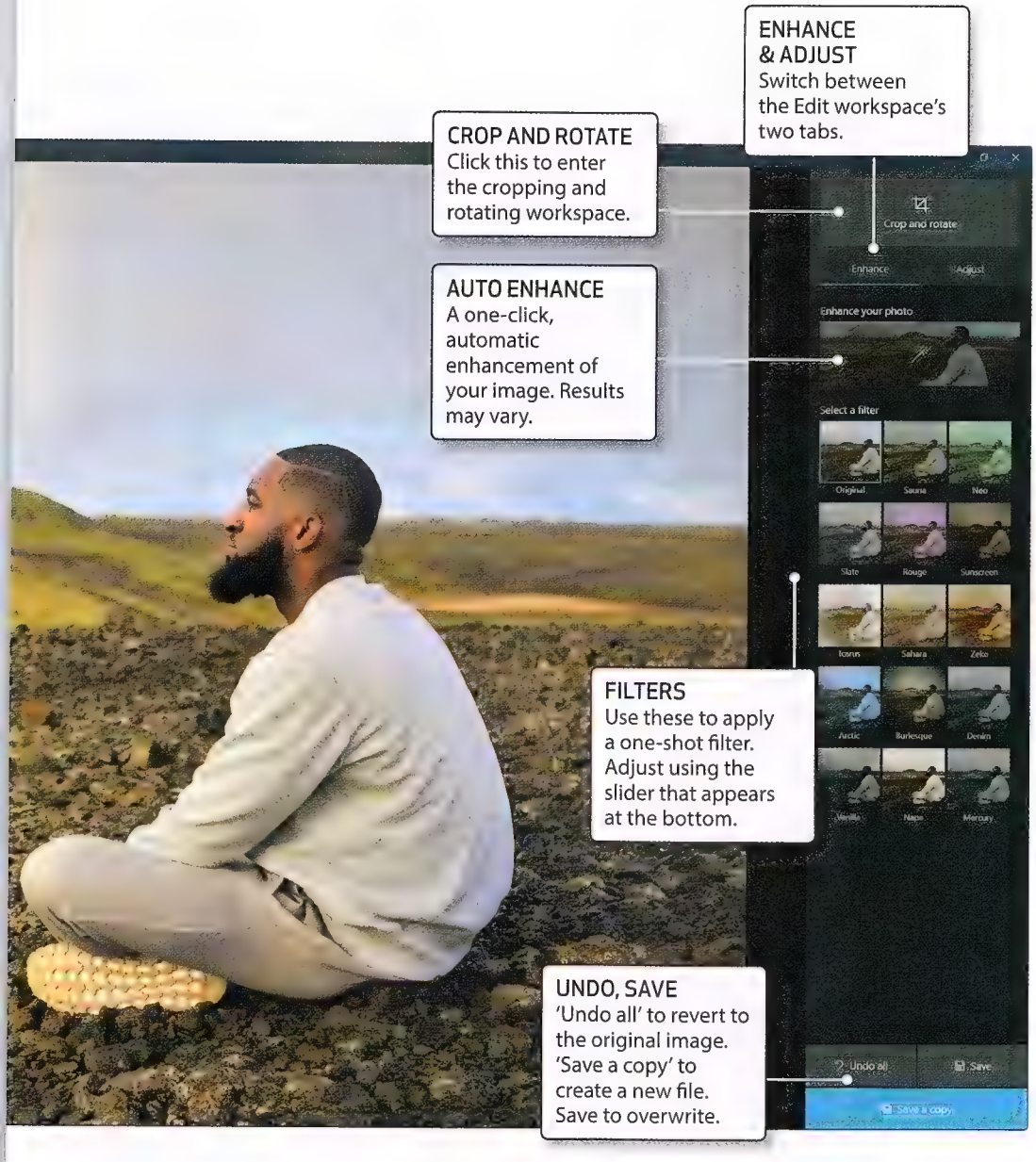


1 OPEN THE PHOTOS APP

Cropping in Windows' Photos app is very straightforward. Open your image in Photos, either by double-clicking it or by choosing the app from the Open With sub-menu, and then click 'Edit and Create' at the top-right of the interface. Choose Edit from the drop-down menu that appears. 'Crop and Rotate' is the topmost option on the right-hand side.

2 CROP AN IMAGE IN PHOTOS

Clicking the option takes you to a screen with a few options on the right. Four circles have also appeared at the corners of your image. Dragging these in with the mouse will moves the picture's edges, and the image will zoom when you release the button. To crop to a particular aspect ratio, use the tool on the right to choose from preset crops or choose Custom to create your own.



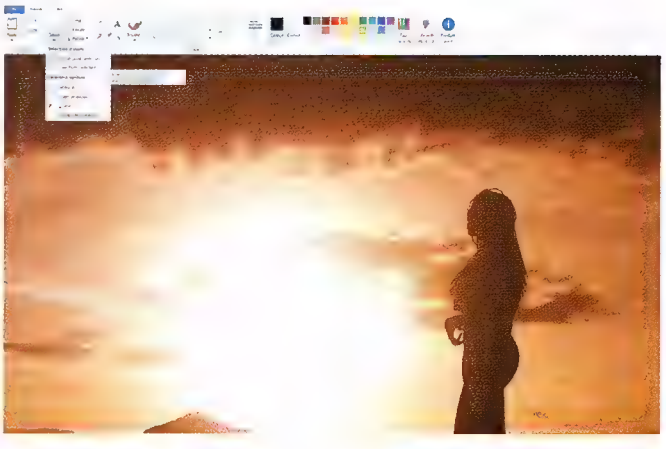
Jargon buster!

CROPPING
Moving the edges of an image in and discarding whatever falls outside its new shape.

VIGNETTE
Darkening of an image's corners due to light hitting the camera lens at a strong angle. Not a problem with many compact digital cameras.

ASPECT RATIO
The relationship between the horizontal and vertical sides of an image, expressed as a ratio. Most TVs, for example, are in a 16:9 ratio.

3 ROTATE AND FLIP IN PHOTOS
You can rotate the image within the crop box so, when you're finished, crooked horizons or leaning verticals appear straight again. There are flip tools, too, which mirror your image horizontally or vertically. You can rotate in 90-degree increments using a button, but the best way to do it is using the 'straighten' slider, which moves up and down to the left of the other tools.



4 CROP AN IMAGE IN PAINT
If you don't want to use the Photos app, try Microsoft Paint instead. Open your photo file in Paint by right-clicking it and choosing Paint from the Open With sub-menu. Note: it's very basic: – you crop using the Selection Shapes on the Home toolbar, but there's no help with aspect ratios, you just draw a rectangular box and hope it's right. Click the Crop button when you're happy.

5 A SNIP AND SKETCH CROP

If you've upgraded to the Windows 10 October 2018 Update, you have a third option: the new Snip and Sketch tool. It also has image-editing capabilities – meant for editing your screengrabs – with a Crop tool found at the right of the toolbar. Again, it's a basic cropping system and you're much better off using the Photos app instead.

7 FILTERS IN PHOTOS

The Photos app comes with one-shot filters that can help enhance your images. They're found under the Enhance tab in Edit mode, but they are a bit limited in range and scope. There is, though, a slider at the bottom of the screen that enables you to alter the intensity of a filter, which always has a default value of 50%. Toning down can give you a more interesting, natural look.

9 CHANGING THE CONTRAST

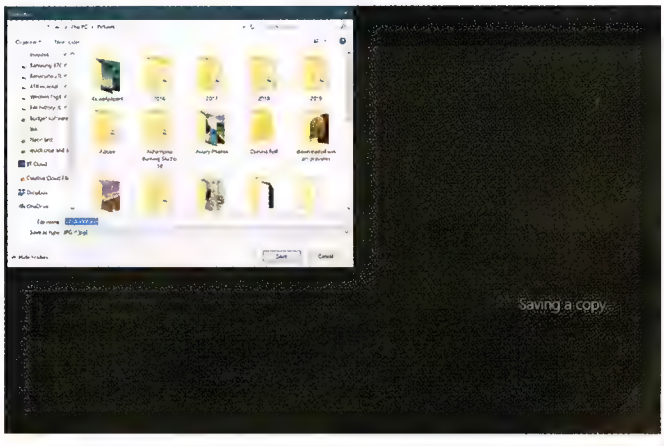
There are two more preview-less sliders below. Clarity affects the contrast of your image, and pushing it to the right will deepen blacks. Sliding it left will create a low-contrast, misty look, with unsaturated colours. The Vignette slider simulates a camera lens effect: the darkening of an image's corners. It's handy for focusing attention on a subject near the centre of your image.

6 USE THE RULE OF THIRDS

In Photos, you may notice that as you adjust the corners of the Crop tool's rectangle a grid appears, dividing the space into nine boxes. This enables you to make a crop based on the rule of thirds, and is one of the easiest ways to improve the composition of an image. The four points at which the lines cross, and the lines themselves, are natural places for objects to go in your photo.

8 TWEAK BRIGHTNESS

Under Photos' Adjust tab you'll find sliders for altering the brightness of an image. The top one is Light, and moving it to the right will lighten your image, while a jump to the left darkens it. If you go too far right, you may end up with a washed-out picture, so the lower slider, Colour, can be pushed right to balance it. Pushing Colour left leaves you with a black-and-white image.



10 SAVE A COPY

Rather than saving over the top of your original photo, you can save a new file with your edits on it. The 'Save a Copy' button lives at the bottom right of the interface _ and is a handy way to experiment with different effects and filters, while leaving your image untouched so you can return to it in future. Save can be used while you're working, to store edits you don't want to lose.

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Make stylised video clips

George Cairns explains how to use LumaFusion to fix colour problems or add creative looks.

There are various reasons why a filmmaker might want to alter the colour and tones of footage. Clips may be incorrectly exposed or suffer from colour casts, for example. These problems can occur when shooting on Auto or in situations with contrasting lighting conditions.

An editor may also want to creatively adjust (or 'grade') their footage to create a particular look, such as making their material look colourful and warm, or washed out and cold, to evoke a particular mood. Amateur filmmakers might use in-camera settings to create high contrasting and vibrantly coloured clips. These clips are harder to adjust in post-production apps because tonal details may be missing from the footage.

Professional video makers often shoot using a neutral camera setting that produces clips with a flat contrast and drab colours. This enables them to capture more shadow and highlight detail. They can then fine-tune the colours and contrast in apps like LumaFusion to get the precise look that they want.

LumaFusion excels at grading thanks to its Color and Effects editor. This enables you to adjust colours and tones to overcome common problems with your original video footage. For example, you can selectively lighten underexposed shadows without blowing out correctly exposed highlights, or boost a landscape's weak and dreary colours without making skin tones look overly orange.

PRESETS AND LAYERS

LumaFusion also provides a collection of colour grading preset effects that instantly alter colour and tone. These presets provide a handy springboard to the grading process, as you can modify their settings to fine-tune the look that they make. You can even combine multiple effects as layers to produce a range of creative results (and turn layers on and off to tweak your custom look).

Once you've graded a clip to perfection you can copy the adjustments and apply them all (or a specific selection) to other non-graded clips.

"LumaFusion excels at grading thanks to its Color and Effects editor. This enables you to adjust colours and tones to overcome common problems with your original video footage."

LumaFusion's powerful grading tools

1 COLOR & EFFECTS
Tap here to access colour grading tools, then a preset (top right) to instantly apply a new look.

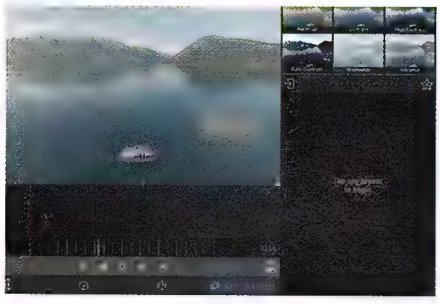
2 CUSTOMISE PRESETS
Drag sliders to tweak a preset. The Levels slider's control points adjust the brightness and contrast.

3 EFFECT LAYERS
You can easily combine effects as layers. Swap the layer order to fine-tune the overall look.

4 ATTRIBUTES CLIPBOARD
Once you have created a graded look, you can simply copy the adjustments and apply them to other clips by tapping this icon.

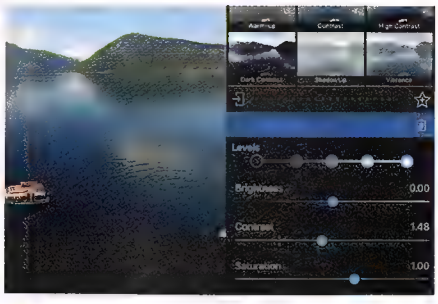
How to

Apply and modify effects presets.



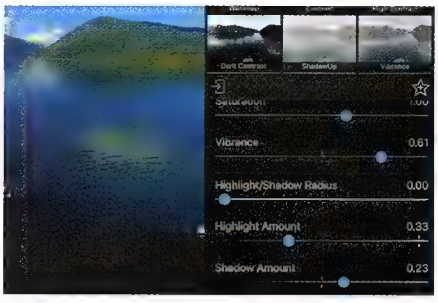
1 ADD UNGRADED CLIP

Drag an ungraded clip to the timeline. We shot our example clip on a GoPro using the Protune setting to create a flat contrast. Tap the Clip Tools (toolbox) icon, then tap the Edit button. In the Edit panel, tap the Color & Effects tab.



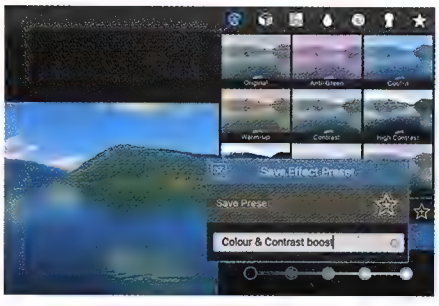
2 APPLY A PRESET

Tap a preset such as Contrast. This gives you sliders to tweak. Drag the Contrast slider right to boost it further. The Levels slider's five handles enable you to adjust shadow, midtone and highlight brightness and contrast.



3 SELECTIVE COLOUR BOOST

Drag Vibrance right to increase the saturation of weaker colours without ruining stronger ones. To claw back more highlight detail in bright skies, drag Highlight Amount left. Lighten shadows by dragging Shadow Amount right.

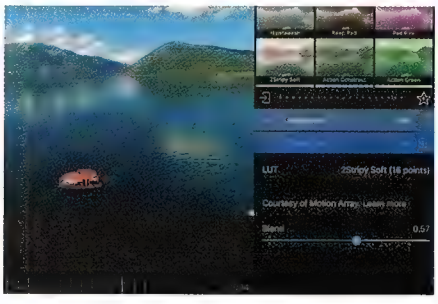


4 CREATE A CUSTOM PRESET

Tap the icon of a star with a + in it to open the Save Effect Preset panel. Type a name for your tailored settings. Tap the icon to save your preset. Tap on the star-shaped custom preset icon at the top right to add this to other clips.

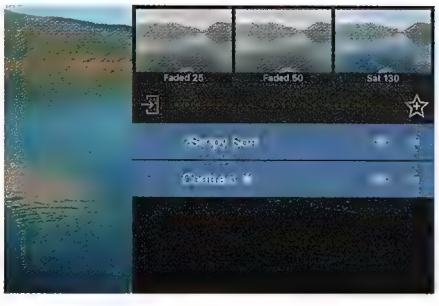
5 ADD LUTS

You can combine custom colour and contrast adjustments with Look Up Tables (LUTs) that add a range of creative looks. Tap the LUT icon. Tap to apply a LUT to the footage. In this example, the colour adjustment is initially too strong.



6 MIX EFFECT LAYERS

Our chosen 2Stripy Soft LUT turns the blue sky to cyan, which is a nice look. To mix the cyan with the contrast and colour adjustments we made earlier, drag the Blend slider to the right. This creates a more subtle mix between the two.

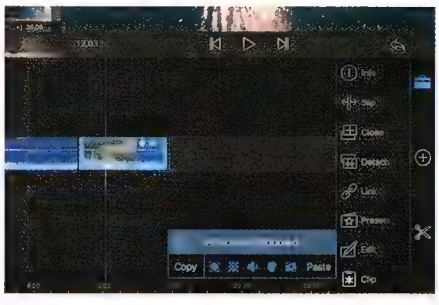


7 REARRANGE LAYERS

Tap the arrow icon to the left of the LUTs label to collapse it. Drag the icon at the right to place the LUT layer above the modified Contrast layer. This changes the way the layers mix and produces a new look. Tap the top-left arrow to go back.

8 COPY ADJUSTMENTS

You now have a graded clip in the timeline. Add a non-graded clip from the same shoot. Tap on the graded clip, then the Clip icon in the Edit panel to open the Attributes Clipboard. Tap Copy to copy the adjustments made to that clip.

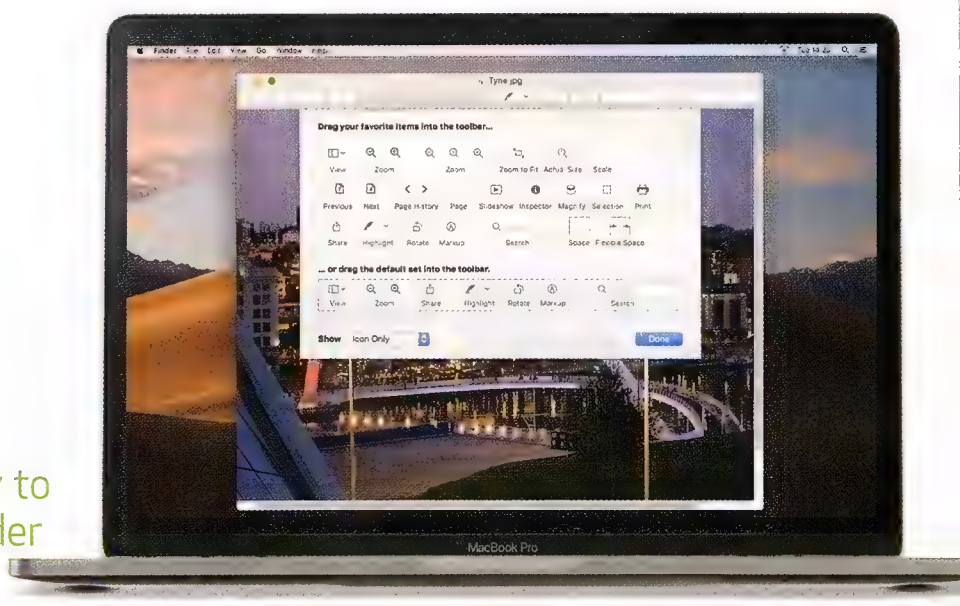


9 PASTE ADJUSTMENTS

Tap on the non-graded clip in the timeline. Our example has similar flat tones and drab colours to those in the first clip before we graded it. Tap Clip to open the Attributes Clipboard panel, then Paste to apply all the same adjustments.

Customise toolbars in macOS

Adam Banks says it's easy to fine-tune tool icons in Finder and other Apple apps.



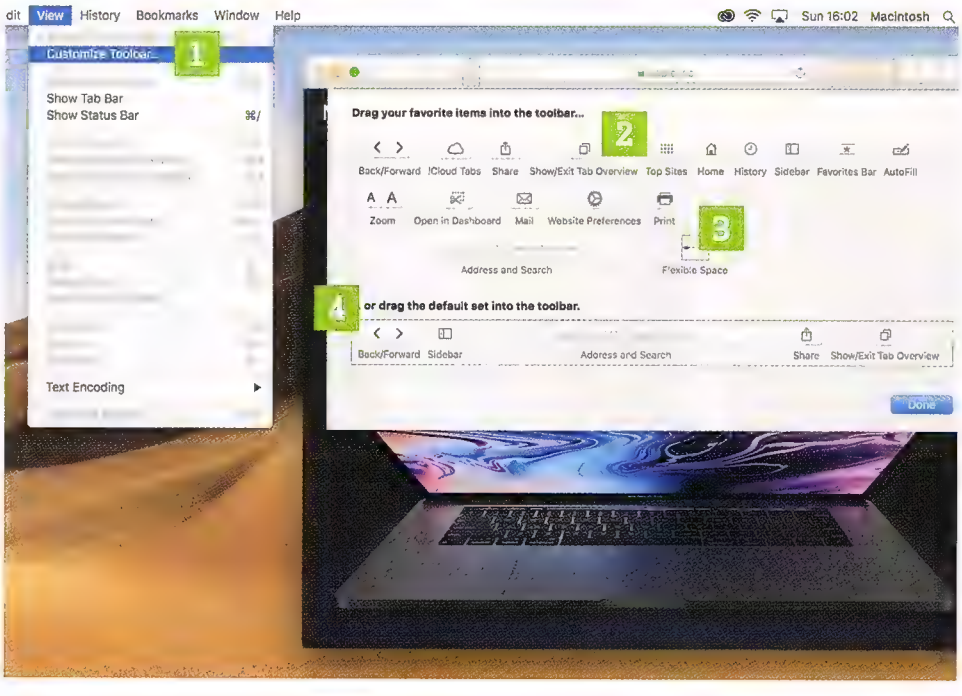
It's easily overlooked that macOS lets you personalise the toolbars at the top of windows in Finder, default apps like Safari, Mail and Preview, and the iWork apps (Pages, Numbers and Keynote). Choose Customise Toolbar from the View menu, or after Control-clicking the toolbar, and a sheet will drop down from the top of the window offering a choice of controls to add.

Not only can you drag tools directly onto the toolbar to add them, or off to remove them, but you can also rearrange their order and insert spaces to group them logically. If the window is too small to show all the tools, a double chevron appears at the right; you'll need to drag the window wider before adding more tools.

Without opening the Customise Toolbar sheet, you can also hold Command at any time and drag icons off the toolbar or rearrange them. There is a risk of doing this accidentally and wondering where your tools went: this is easily fixed using the Customise Toolbar sheet's option to restore the default set, overwriting the current configuration.

> "Not only can you drag tools directly onto the toolbar to add them, or off to remove them, but you can also rearrange their order and insert spaces to group them logically."

Explained... Customise Toolbar options



1 VIEW MENU
Bring up the customisation sheet by Control-clicking the toolbar, or choosing it from the View menu.

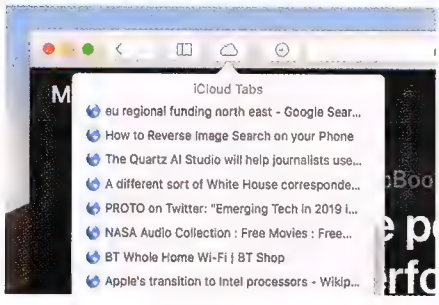
2 TOOL BUTTONS
Each built-in app has its own set of tools, which will also be available in menus if not on the toolbar.

3 FLEXIBLE SPACE
Gaps made with this item will expand with the window size. Some apps also provide fixed-width spaces.

4 DEFAULT SET
Drag this entire block to the toolbar to reset the configuration to the default tools only.

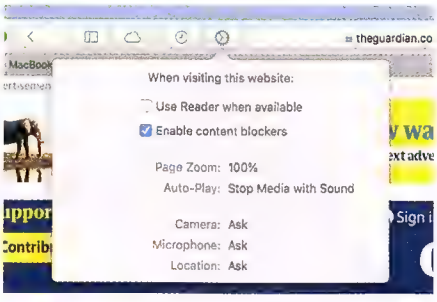
How to

Choose and arrange the tools you want >


iCloud Tabs
eu regional funding north east - Google Sear...
How to Reverse Image Search on your Phone
The Quartz AI Studio will help journalists use...
A different sort of White House corresponde...
PROTO on Twitter: "Emerging Tech in 2019 i...
NASA Audio Collection : Free Movies : Free...
BT Whole Home Wi-Fi | BT Shop
Apple's transition to Intel processors - Wikip...

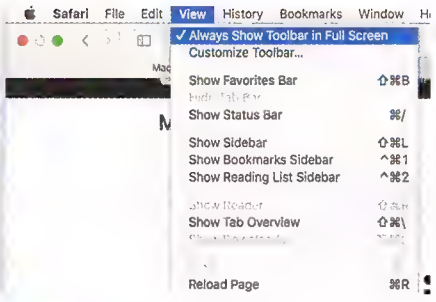
1 ICLOUD TABS

In Safari, you have quick access to web pages that are currently open on your other devices, but only by going to View > Show Tab Overview and scrolling down. Add the iCloud Tabs icon and you get them as a handier pop-up.



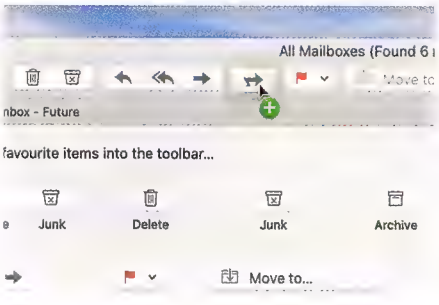
2 WEBSITE PREFERENCES

Add the Website Preferences button near Safari's search/address bar to remind yourself that you can alter default settings and permissions per site. Hover over each item to get a pop-up menu allowing you to change it.


Safari File Edit View History Bookmarks Window
Always Show Toolbar in Full Screen
Customize Toolbar...
Show Favorites Bar ⇧⌘B
Show Status Bar ⌘/
Show Sidebar ⇧⌘L
Show Bookmarks Sidebar ^⌘1
Show Reading List Sidebar ^⌘2
Show Tab Overview ⇧⌘\
Reload Page ⌘R

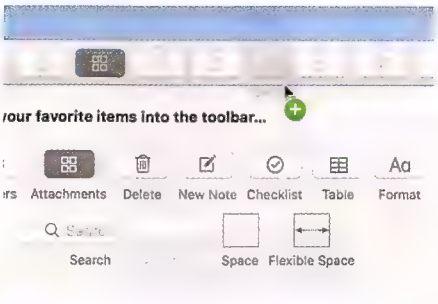
3 FULL-SCREEN TOOLBAR

In any app, in full-screen mode, you can choose whether the toolbar hides itself or shows itself (the latter ensures website security status remains visible in Safari). This even applies to Photos, whose toolbar isn't otherwise alterable.



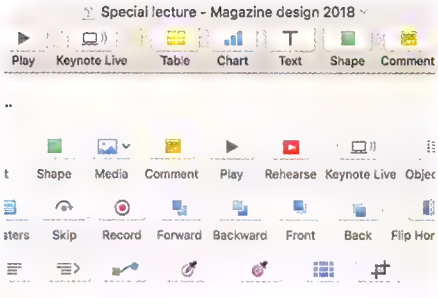
4 REDIRECT MAIL

The Redirect command in Mail's Message menu forwards a message with its original presentation — no indents are added, which can ruin formatting. This useful option is omitted from the default toolbar. Now you know how to add it.



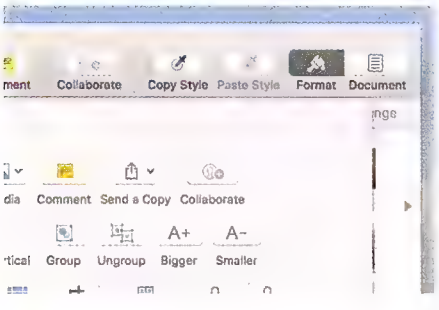
5 SPACING ITEMS

The Flexible Space item separates groups of icons that will stay together; add a (non-flexible) Space to separate tools within a group. (Safari omits fixed spaces, presumably because they'd mess up the centred address/search bar.)



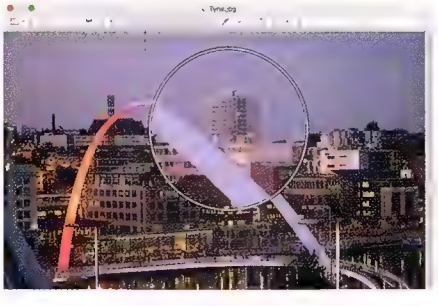
6 IWORK TOOLS

In iWork apps such as Keynote, it's well worth adding tools normally hidden in hard-to-remember palette locations. Just watch out for the toolbar getting full, indicated by the double chevron at the top-right of the app's window.



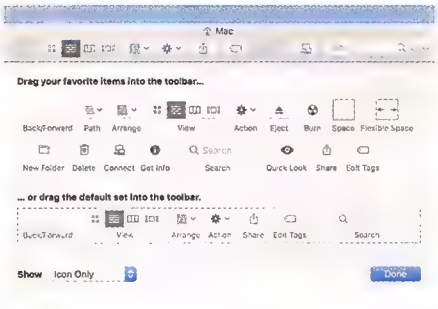
7 REUSE STYLES IN PAGES

Two of the most useful commands missing from Pages' default toolset are Copy Style and Paste Style, which are also absent when you control-click an item. Thankfully, you can add them to the toolbar for superfast access.



8 PREVIEW'S MAGNIFIER

The Preview app doesn't have a lot of tools, but one of the handiest is the Magnifier (Tools > Show Magnifier). Add a toolbar button for it to remind yourself it exists and avoid having to recall its unusual keyboard shortcut.



9 FINDER'S KEEPERS

Add buttons for practical Finder features that are easily missed, such as 'Connect to Server' (also in the Go menu) and the Path button. The latter's effect would normally be done with View > Show Path Bar or Control-clicking the window title.

Scan and digitise photos and documents

Nick Peers reveals the best way to set up, troubleshoot and use your scanner to its fullest in Ubuntu 18.04.

Sadly, if there's one piece of hardware that Linux hasn't yet quite got the hang of, it's scanners. Sure, the SANE back-end – SANE as in Scanner Access Now Easy – performs beautifully when it works, but it's the working bit that's so frustrating. If your scanner is supported directly by SANE itself then all is usually fine, but introduce third-party drivers and things can get a lot trickier.

Which is where we come in. In this tutorial we'll look at getting your scanner working in SANE, revealing a selection of troubleshooting tips to try should things not pan out as planned. Once that's installed, we'll take you on a practical guide to making use of your scanner using free software to transform your photos and documents into digital files, complete with tips and tricks for getting the best results.

GETTING STARTED

The SANE backend is baked into most flavours of Linux, including Ubuntu and its derivatives; we're using Ubuntu 18.04 LTS as the focus of this tutorial. Start by taking a trip to **www.sane-project.org** and click 'Supported devices' to see if your scanner is on the list. If it's listed as anything but unsupported, fire up the Simple Scan application that's also preinstalled with Ubuntu. If your scanner is detected, you're good to go – jump to the next section.

Things are rarely that simple, however, so don't panic if it doesn't show up. First, you need to verify the scanner has been detected by Ubuntu itself – open a Terminal window and enter the following command:

```
$ lsusb
```

You should see a list of USB-connected devices, with your scanner's manufacturer listed among them. Assuming this is the case, try the following command:

```
$ sane-find-scanner
```

This may or may not detect your scanner, but it's likely several USB devices will be inaccessible for permissions reasons, so try this:

```
$ sudo sane-find-scanner
```

If your scanner is now detected, try the following:

```
$ scanimage -L
```

No luck? Try `sudo scanimage -L` and if that works, you may need to run Simple Scan (or indeed any other scanner software) using sudo from the Terminal – `sudo simple-scan` for example. In this event, a permissions issue is the cause of your problem. You may be able to temporarily resolve it with the following:

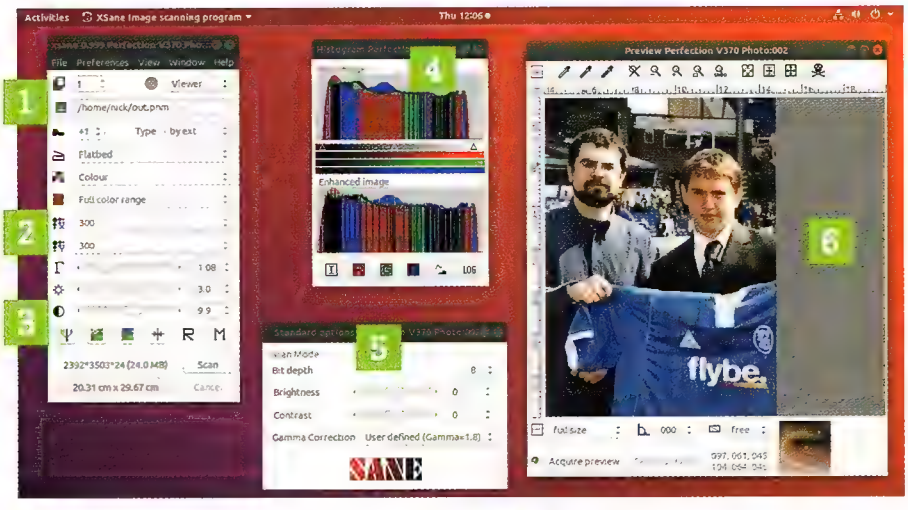
```
$ sudo chmod u+w /dev/bus/usb/001/002
```

Replace 001 with your scanner's Bus number, and 002 with its Device number as revealed with the `lsusb` command. This should allow you to use your scanner without invoking `sudo` permissions, but will only work until you reboot.

THIRD-PARTY DRIVERS

If your model is listed as Unsupported on the SANE project page, don't panic. It should reference support for another source, such as 'epkowa backend plus non-free interpreter' in the case of selected Epson scanners such as our test Perfection V370 Photo. Even if your scanner isn't listed at all – as our Dell B1265dnf multi-function device wasn't – don't give up just yet. Start your search for a suitable driver with a trip to

Get familiar with XSane...



1 BASIC OPTIONS
Choose a destination and filename for your scan, then select the source (typically flatbed, document feeder or transparency unit) and colour.

2 SET RESOLUTION
It's possible to set different horizontal and scan resolutions (in dpi) using XSane, but for most people you'll want to keep these identical.

3 GAMMA CONTROLS
You can manually set gamma, brightness and contrast here, or take advantage of the automatic settings (including an option for scanning negatives).

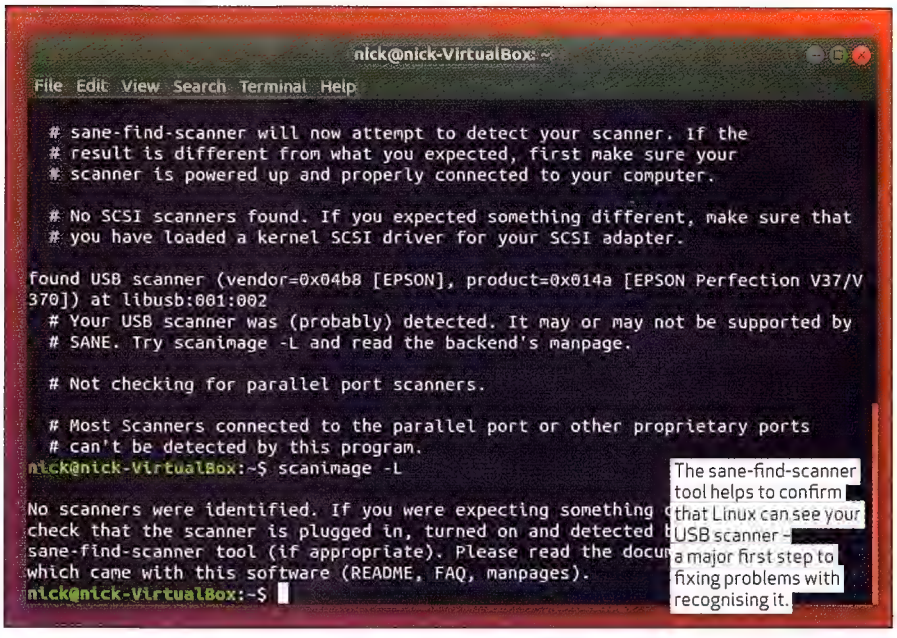
4 HISTOGRAM
The Histogram works in a similar way to an image editor's Levels control – adjust the white, grey and black points using the sliders beneath the top graph.

5 STANDARD OPTIONS
Provides basic brightness, contrast, bit-depth and gamma options – choose Window > Show Advanced Options if you're feeling brave.

6 PREVIEW WINDOW
Acquire a preview of your image, then crop using the zoom controls before using the white, grey and black droppers to tweak colour settings.

your scanner manufacturer's website to see if Linux drivers are provided and easily accessible. If they are, follow the instructions to download and install these – in most cases, they'll come with an install.sh script, which you'll need to run from the Terminal following the step-by-step guide (over the page). If not, Google your scanner make and model plus 'Linux' for results.

In an ideal world that should be it: opening Simple Scan should now work, but if it still comes up blank or you're told you need to install additional software for your scanner, it means the drivers haven't been installed properly. Changes to later versions of Ubuntu have introduced compatibility issues with SANE – the troubleshooting box reveals more along, with a specific workaround for Epson scanners.


nick@nick-VirtualBox: ~
File Edit View Search Terminal Help
sane-find-scanner will now attempt to detect your scanner. If the
result is different from what you expected, first make sure your
scanner is powered up and properly connected to your computer.
No SCSI scanners found. If you expected something different, make sure that
you have loaded a kernel SCSI driver for your SCSI adapter.
found USB scanner (vendor=0x04b8 [EPSON], product=0x014a [EPSON Perfection V37/V
370]) at libusb:001:002
Your USB scanner was (probably) detected. It may or may not be supported by
SANE. Try scanimage -L and read the backend's manpage.
Not checking for parallel port scanners.
Most Scanners connected to the parallel port or other proprietary ports
can't be detected by this program.
nick@nick-VirtualBox:~$ scanimage -L
No scanners were identified. If you were expecting something
check that the scanner is plugged in, turned on and detected
sane-find-scanner tool (if appropriate). Please read the docu
which came with this software (README, FAQ, manpages).
nick@nick-VirtualBox:~$
The sane-find-scanner tool helps to confirm that Linux can see your USB scanner – a major first step to fixing problems with recognising it.

A SIMPLE SCAN

Once everything's working correctly, you're ready to start making the most of your scanner. As we said, Ubuntu ships with a built-in tool called Simple Scan, so let's start with this. Open it and wait for a short time until your scanner model is listed – this means it's working and ready to go. You'll see the big green scan button; place a photo on your scanner's flatbed and click Scan, and in a short while the image will appear in the main window.

The entire scan area will be scanned and once complete you'll see a few controls appear at the bottom of the main window. Use the rotate buttons to flip the image if necessary, then click the scissors button to switch to crop mode, enabling you to reposition and size the selection square to surround the part of the scan you wish to keep.

Once done, click the save button at the top of the program window next to the hamburger icon. You have a choice of four formats: PDF (best for documents), JPEG, PNG and WEBP (for images). Choose PNG for maximum quality, or JPEG to share it online. Click the menu button and you'll also see an option to email your scan; this inserts it as a file attachment (or attachments if it's a multi-page scan) in JPEG format.

Once done, click Start Again to move onto your next scan – you'll be prompted to save your scan if you've not already done so.

MULTI-PAGE SCANS

Despite its name, that's not all Simple Scan can do: click the down arrow next to the Scan button and you'll see options for scanning text (basically black and white) as well as photos (full colour). Simple Scan also supports multi-page scanning, either through an automatic document feeder or the Multiple Pages From Flatbed option. Choose the latter after placing the first page on the scanner. Once it's finished, you'll have around 10 seconds to swap the page for a new one before Simple Scan carries on. This continues in perpetuity until you click Stop.

The pages are displayed in a single row; to change their running order, choose Reorder Pages, which gives you four options: Combine Pages, Combine Pages (Reverse), Reverse, and Keep Unchanged. Single pages can be reordered directly from the scan window – simply right-click a page and choose Move Left or Move Right as required. You'll also see options for rotating and cropping that individual page, plus copying it to the clipboard or deleting it if required.

Other tweaks can be performed via the Preferences dialogue, accessible under the 'hamburger' menu. This is split into two tabs: Scanning enables you to switch between scanners and configure various page-related options – including adjusting the delay when using the Multiple Pages From Flatbed setting. In Quality, you can set the correct resolution and tweak brightness and contrast settings for over- or underexposed images. These are rather crude tools for performing corrections, but good enough for minor adjustments.

ALTERNATIVE APPLICATIONS

If you're a seasoned scanner, or have photos to scan that require more options than those supplied by Simple Scan, there are several alternatives available. If you installed a third-party driver you may find your scanner manufacturer supplied its own

Troubleshoot drivers installation

Sadly, since Ubuntu 16.04 was released, updates to SANE appear to have partially broken scanning capabilities in Ubuntu. Many scanners that worked fine in earlier versions of Ubuntu no longer work in later versions, and both our test scanners (Dell B1265dnf and Epson Perfection V370) fell into this category.

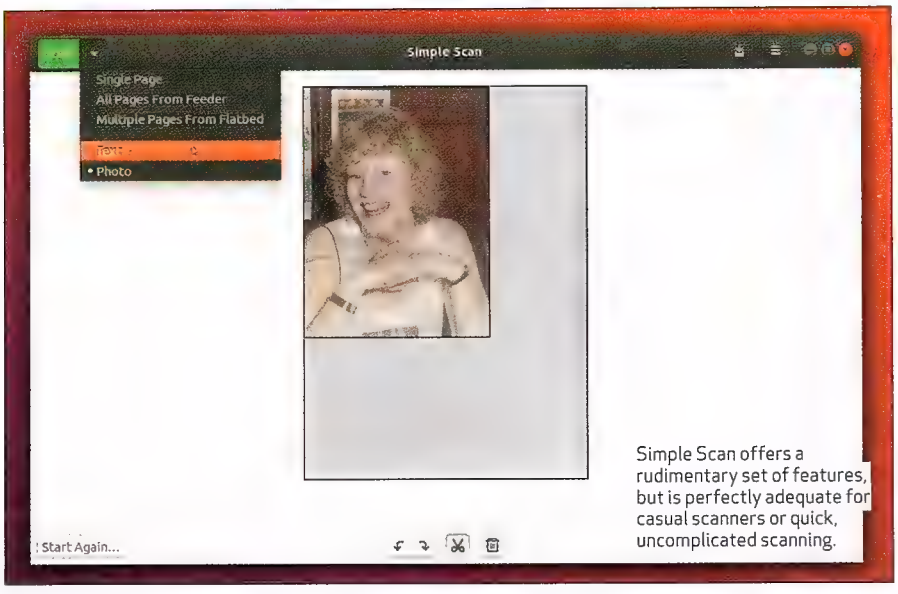
The first thing to do is visit **tinyurl.com/apc467-scan** where you'll see this problem documented in detail.

```
$ sudo ln -sfr /usr/lib/sane/libsane-epkowa* /usr/lib/
x86_64-linux-gnu/sane
$ sudo nano /etc/udev/rules.d/79-udev-epson.rules
```

Enter the following into the empty file:

```
# chmod device EPSON group
ATTRS{manufacturer}=="EPSON", DRIVERS=="usb",
SUBSYSTEMS=="usb", ATTRS{idVendor}=="04b8",
ATTRS{idProduct}=="*", MODE="0777"
```

Save the file, then reboot. Similar fixes have been posted for Brother and Xerox scanners. As you can see, it appears to be an issue with both permissions and changes to file locations that necessitate the use of symlinks to get things working again. Other afflicted scanners may be fixable using these basic principles.



Simple Scan offers a rudimentary set of features, but is perfectly adequate for casual scanners or quick, uncomplicated scanning.

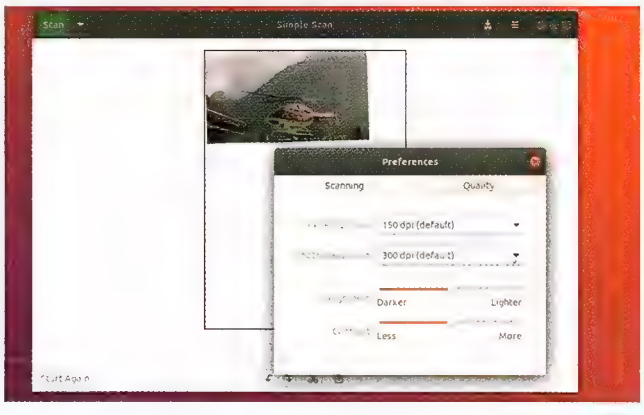
scanning app – Image Scan in the case of Epson scanners, for example. One of the advantages of more powerful alternatives is that they provide a preview function, as well as on-screen options that can be combined to let you change scan settings while getting a rough idea of how those adjustments will affect the scanned image before you commit to a full scan. They also offer a wider array of adjustments that can be used to correct minor issuess like colour, lighting or the effects of dust, speckles and other so-called 'noise'.

Image Scan provides a two-paned window, with a zoomable preview in the left pane and a series of controls split into three tabs (Document, Image Controls, Tone Correction) on the right. It's also capable of turning your scanner into a photocopier if your printer supports it: select Printer under Destination before clicking Scan. It also supports other Epson-specific features such as scanning negatives.

Scan at the right resolution

When you scan a photo or document, you do it at a specific resolution, measured in dpi (dots per inch). The more dots per inch n your scan, the more detailed, and larger, your image. By default, Simple Scan scans documents at 150 dpi and photos at 300 dpi, which will produce a digital image the same size as the original (typically A4 for documents, 6x4 inches for photos). This is sufficient in most cases, but there may be times when you wish to blow up a photo to a larger size – for example when scanning smaller photos of the sort often found in family history collections.

As a rule of thumb, you should be able to get away with blowing up an image to twice its size with no problems – so 600 dpi to print a 6x4-inch photo at A4, or to increase a passport-sized photo to 2x3 inches. The other consideration is file size: double the DPI and you increase the file size by a factor of four, so bear this in mind if you intend to email the image to someone else, for example.



To change Simple Scan's resolution, open Preferences and switch to the Quality tab.

If your manufacturer doesn't provide an alternative, but you'd like a more powerful option, start by looking at Skanlite, available through the Ubuntu Software Store. Like Simple Scan, it'll work with any scanner recognised by SANE, but offers a preview window like Image Scan. It also provides numerous correction tools to fix problems with lighting and colour.

Skanlite is somewhat let down by the fact the preview doesn't update in real-time – whenever you tweak the settings, you need to generate a fresh preview to see how they'll affect your image before scanning. If you can live with this limitation, however, there's plenty to recommend installing Skanlite along with your other scanning tools to see if it fills in any gaps, so to speak.

INTRODUCING... XSANE

At the opposite end of the spectrum to Simple Scan is XSane, which is available both as a standalone application through the Software Centre and a plug-in for the GIMP image editor (once installed, you can access it via GIMP's File > Create menu).

XSane is not for the faint of heart. As the annotation reveals, it's split into separate windows, which can be shown or hidden via the Window menu from the main screen. It can look a bit bewildering as first, but start by setting things up in the main XSane window as outlined in the annotation. Choose a destination for your scan and select a specific file type – XSane offers a wider choice than Simple Scan, but again we'd recommend PNG for locally stored copies, JPEG for images you plan to share over the internet and PDF for general documents.

Click the Colour drop-down menu to choose Grey for old black-and-white photos, or Binary for text documents. Leave 'Full Color Range' selected unless you're scanning slides or negatives. Beneath this are the horizontal and vertical resolution settings in dpi – the 100 figure is too low, so check out the 'Scan at the right resolution' box on the left for some handy tips.

You're now ready to create a preview to guide any further pre-scan adjustments. Select Window > Show Preview if necessary, and then click Acquire Preview. If the preview comes out upside down or on its side, use the rotate button beneath the main window to rotate 90 degrees in any direction.

Next, click and drag around the part of your photo or document you want to scan. To constrain the aspect ratio, click the Free button beneath the preview first and choose your desired setting (normal 6x4-inch photos would be 15:10 for landscape and 10:15 for portrait, for example). Click the selection with your right mouse button to move it into the

correct position if necessary. Once you've done that, click the 1:1 magnifying glass button to fill the preview with your selection, then click Acquire Preview again to obtain a higher-resolution preview of the image.

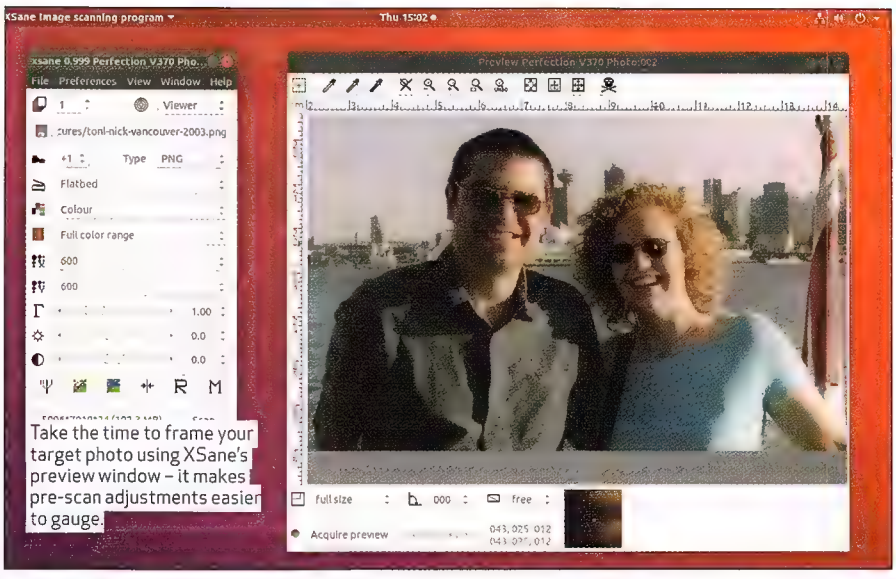
IMPROVE COLOUR AND LIGHTING

With your selection framed, see if you can improve the image by tweaking its colour and gamma settings. Start by clicking the auto-adjust button in the main program window – it's the third from the left. You should see an immediate improvement; if you're happy you can now proceed to scan by clicking the appropriate button.If you want to go farther, there's plenty of scope for making your own changes.

One method is to use the three dropper buttons on the preview window to manually set black, grey and white points in your image. Select each dropper in turn and then click part of the image where you see black, white or a mid-tone (grey). As you roll your mouse over part of the preview you'll see a smaller preview window in the bottom of the main preview, showing an extreme close-up of the pixels around the selected area and thus enabling you to select more precisely. Remember, this is only a preview, so don't worry that it looks pixelated – your final image won't be.

If you mess things up, either click the auto-adjust button again, or click the button to its immediate right, which will reset gamma, brightness and contrast controls to their defaults.

You can also adjust levels using the histogram; look carefully at the top graph and you'll see three sliders beneath it, representing black, grey and white. Experiment with moving them along the line to see how they affect the original image. By default, the histogram shows luminance, red, green and blue colours together – the buttons at the bottom enable you to exclude them from the histogram, but they have no relationship to your tweaking, as that affects luminosity across the entire image.



Take the time to frame your target photo using XSane's preview window – it makes pre-scan adjustments easier to gauge.

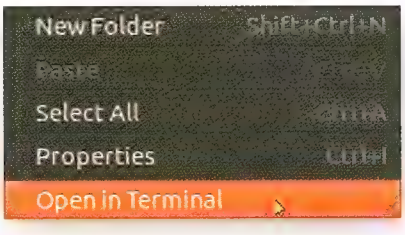
If you'd like to adjust individual colours – for example, to correct a greenish hue – click the RGB default button (on the far left) on the main window to reveal separate sliders for gamma, brightness and contrast. A fair amount of experimentation is required here. If the extended dialogue box disappears below your screen, you'll need to open Preferences > Setup > Display tab and untick Main Window Size Fixed. Click OK and restart the program to allow you to convert it into a scrollable dialogue box.

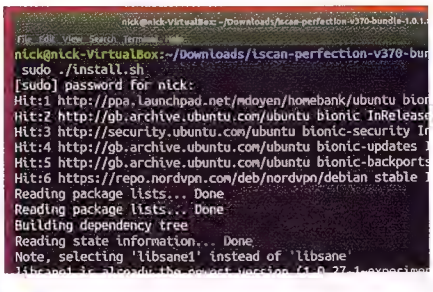
BATCH SCANS

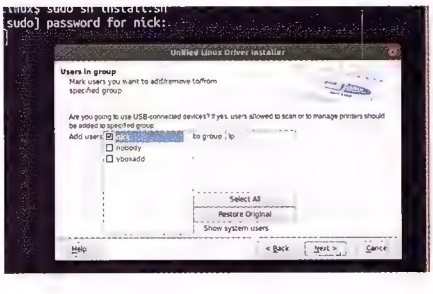
One handy feature XSane offers is a 'batch scan' tool. Basically, place two or more photos on the scanning area then perform a preview. Select and prepare your first image following the advice above, and click the + button in the top-left corner of the Preview screen to add that selection to the batch scan queue. Choose Window > Show Batch Scan to view the list.Click one to select it, enabling you to make further edits to that specific image, before clicking the + button to add it as a new entry in the batch list (you should then delete the original entry).

The Batch List window also enables you to name each specific 'area', rotate or flip the image and, of course, remove it from the list, which can also be saved and retrieved later. When you're ready to scan your selected images, click Scan Batch List to scan each area in turn. Once complete, they'll open in XSane's viewer, where you'll find additional options such as despeckle and blur filters. You can apply these to the digital image before saving it and moving on to the next item in the list.

Install a scanner driver tarball package






sudo] password for nick:
Unified Linux Driver Installer
Users in group
Mark users you want to add/remove to/from specified group
Are you going to use USB-connected devices? If yes, users allowed to scan or to manage printers should be added to specified group
Add users
to group lp
nobody
vboxadd
Select All
Restore Original
Show system users
Help
< Back
Next >
Cancel

1 OBTAIN AND EXTRACT INSTALLER
Locate the driver for your Linux distro. Save the gar.tz file to Downloads, then right-click it and choose Extract Here. Open the extracted folder and find a file called install.sh. Right-click inside that folder and choose Open In Terminal.

2 START INSTALLATION
A Terminal window opens. Type the following command and press Enter, entering your root password when prompted: $ sudo sh install.sh . After a short pause either an installer wizard pops up or a script will run to install the driver.

3 FOLLOW INSTALLER WIZARD
If a GUI wizard pops up, run through it. If you get a prompt about SANE being missing, click Install Anyway, then Next. If prompted, make sure you allow access to your device through the USB port. Disable LPT port support if prompted.

Activate a fan with motion control

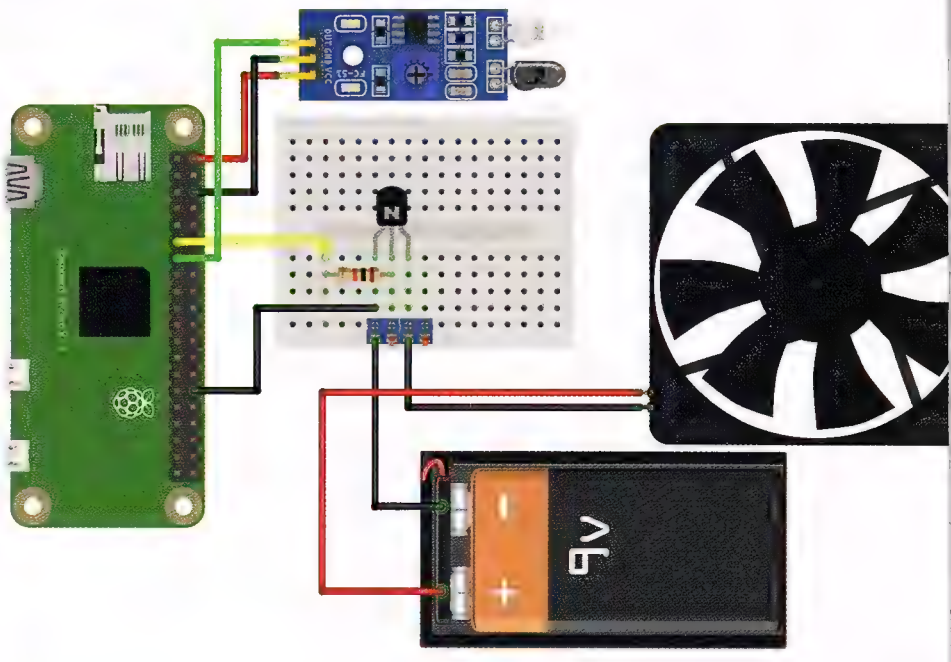
Les Pounder shows how to safely control higher voltages with a Raspberry Pi and two very cheap electronic components.

For this issue's project we'll see how to control higher voltages with our Pi using two different 'switches'. The first is a small component called a transistor, specifically an NPN 2n2222 transistor that is safe to use up to 30V. The second component is a relay which can handle much higher voltages. But no matter what, always stay safe when working with higher voltages. You may just damage your Pi, but you might also hurt or kill yourself.

PROJECT 1: NPN TRANSISTOR

An NPN transistor is basically a switch, and we can use it as one with our Raspberry Pi. Looking at our 2n2222 transistor with the flat side facing us, we see three pins. Pin 1 is the emitter, pin 2 the base and pin 3 is the collector. Our 9V circuit has a broken GND connection between the collector and the emitter – so when the transistor is not activated, the connection remains broken. But when we apply a voltage from our Raspberry Pi GPIO to the base pin of the transistor, we can turn on the transistor and force the switch to close the connection, thus allowing the current to pass from the collector to the emitter. In this project we'll use an obstacle sensor (**tinyurl.com/apc467-pi**), which is really a short-range infrared sensor, to act as a trigger to turn the fan on.

The hardware build for this project is not too difficult. Consult the diagram and take your time. Try to break the build down into sections, and check your wiring. Your Raspberry Pi will not survive 9V connected to its GPIO, so double-check before connecting. You will notice in the diagram that the 9V+ connection from the battery to the fan is directly connected. In the real world this can be achieved by twisting the wires together, or by using a Wago 221 two-port connector (around $2) to clamp the wires in place. High-resolution diagrams are in the download for this project.



The 2n2222 NPN transistor is tiny, but can control much higher voltages than can be safely controlled with the Raspberry Pi's GPIO.

> "The hardware build for this project is not too difficult. Consult the diagram and take your time. Try to break the build down into sections, and check your wiring."

Power up the Raspberry Pi and from the desktop go to the main menu, then the Programming menu and select Python 3 Editor. Once the editor opens, immediately click File > New and from the new window click File > Save. Call the project fan-control.py and click Save. Subsequent saves will be much quicker, and remember to save often.

There is very little code for this project and this is because we are using the GPIO Zero library created by Ben Nuttall, Community Manager at the Raspberry Pi Foundation. GPIO Zero abstracts away a lot of the complexities of using the GPIO and this means that newcomers can just get started writing code. This enables us to create a gesture-controlled fan in just five lines of Python code.

The first line handles importing two classes from the GPIO Zero library. These are DigitalOutputDevice and MotionSensor. The former is a class which enables us to create a new output device, in this case our fan, and control it exactly how we want to. The latter is used with our obstacle sensor; it reads the status of the output pin on the sensor and

react to how we program it.

```
from gpiozero import
DigitalOutputDevice,
MotionSensor
```

Our connection to the fan is made from GPIO 17 on the Raspberry Pi, and this connects to the base of our 2n2222 transistor via a 1K Ohm resistor. This is present to protect the GPIO from the 2n2222, which may pull a little too much current and damage the pin.

In order to use this connection we need to tell the code that it exists, so we create an object called fan and use the DigitalOutputDevice class to specify that we are using GPIO17:

```
fan =
DigitalOutputDevice(17)
```

Next we create another object for our obstacle sensor, a cheap and commonly used sensor in robotics that ensures a robot doesn't drive into a wall. For this sensor we use the MotionSensor class, as this works identically to a PIR (Passive Infrared) sensor.

```
sensor = MotionSensor(27)
```

Now we create a loop that will constantly run our code. For this we use the while True loop.

```
while True:
```

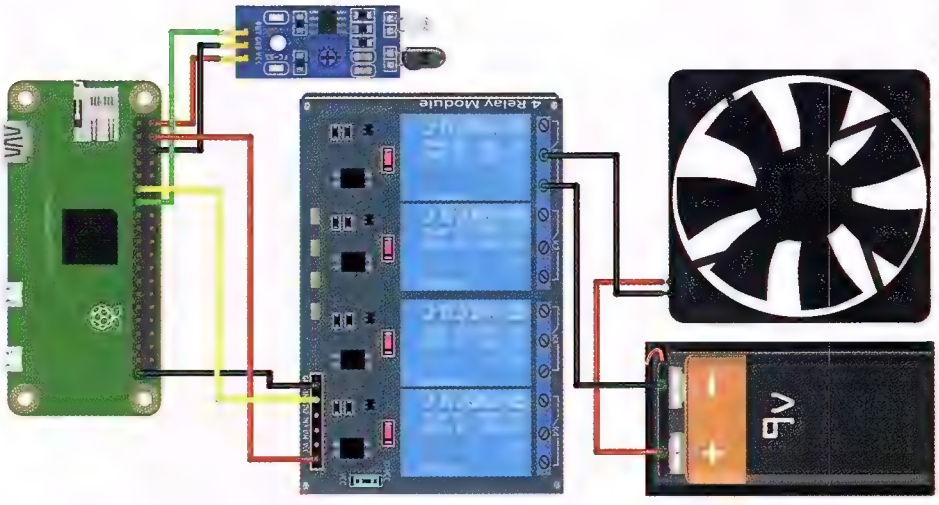
The final line of code is indented four spaces – one Tab key press – automatically by the editor. Indentation in Python can mean many things, but in this case it means that our code belongs inside the loop and should be run when the loop is run. The code that is run checks the status of the obstacle sensor, to which we have created a link using the sensor object. When the sensor detects motion the output pin will change from low to high, and this change of state is what the GPIO pin on our Pi is looking for.

The change of state will trigger our code to call the fan object with the toggle attribute. In other words, it turns GPIO17 on or off depending on its current state. This toggle will then toggle the base pin of the 2n2222 transistor on or off, and therefore close/open the circuit, enabling the 9V circuit to operate and power our fan.

```
while True:
    sensor.when_motion =
fan.toggle
```

Save the code and when you're ready, click Run > Run Module to start. Now wave your hand in front of the sensor and your fan should come to life. You may need to tweak the sensitivity of the sensor using the potentiometer on it; you'll need a flat-blade screwdriver for this.

So now we can control a fan using a transistor, but sometimes we need a switch that can handle a higher voltage and current. For that we need a MOSFET or a relay. Relays are mechanical switches that can handle much higher voltages than our NPN transistors (see 'Working with higher voltages', right) but they should be used with great care.

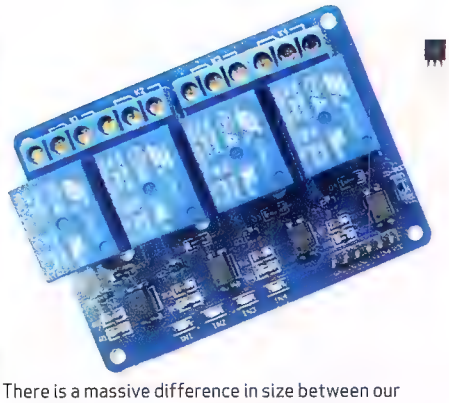


Relays enable us to use much higher voltages with our Raspberry Pi, but we must always keep safe and have the knowledge to work with high voltages.

PROJECT 2: USING A RELAY

To replace our NPN transistor with a relay requires that we alter the circuit. Essentially we remove the breadboard, and using the female to female jumper jerky we connect the 5V and GND pins from the Pi to the VCC and GND pins on the relay board. Then using another jumper jerky, connect GPIO17 to IN on the relay. If you're using a multi-channel relay, ensure that the IN pin used matches the relay being controlled. In our diagram we used IN1 and relay 1.

On the other side of the relay we have the 'high voltage' connections. For our connection we need to connect the two wires from the battery GND and the fan GND so that they are in the screw terminals for Normally Open; these can be identified via the diagram on the relay, or by the letters NO. Connect the wires and start the code once more. You should now hear a click and see/feel the fan start up. ■



There is a massive difference in size between our transistor and a relay. Choosing the right component for a project can be very important.

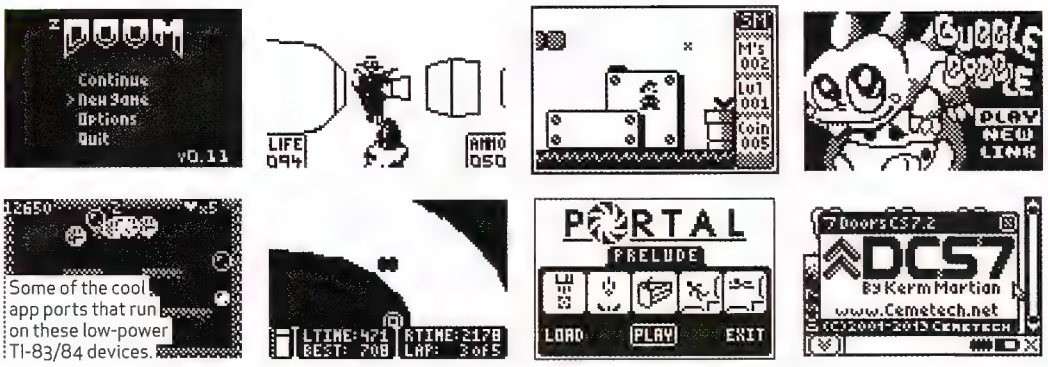
Working with higher voltages

First, let's make this clear. Only work with high voltages if you know exactly what you are doing as you can be seriously injured or killed!

In this tutorial we worked with higher voltages, in that we used a 9V circuit to power the fan but controlled the circuit using the 3.3V Raspberry Pi GPIO. But how did we know what to use as our switch? Well, we consulted a datasheet.

Datasheets are documentation provided by a company that manufacture components. To find a datasheet for the 2n2222 NPN transistor, we used a search engine and located an appropriate document. Then, with a coffee, we sat down and read about the voltages and currents that our transistor could tolerate.

We learnt that the emitter could be used with up to 30V and that it could supply up to 800mA. Our fan only draws around 72mA when in use, peaking at 120mA when it starts, so we were well within the safe operation region. If we went over 30V 800mA then we would need something a little beefier, and for that we could use a MOSFET which are designed for much higher currents. Our power source could have beed replaced with a 12V DC source in that case, but we chose to use a relay which can handle up to 250V AC at 10A.



Some of the cool app ports that run on these low-power TI-83/84 devices.

The TI-83 Plus graphing calculator packs in a Zilog Z80 CPU, but lacks USB.

Building a link to the past with Android

Take an Android phone, an Arduino maker board and an old Texas Instruments calculator and you have a recipe for a retro handheld computer. Darren Yates explains.

Remember the last time you used a calculator? I mean an actual real-life calculator? If you grew up in New South Wales, chances are it was probably during your HSC Maths exam with the calculator that's lived in different forms for nearly 40 years, Casio's FX82. Sure, calculators aren't thrill-a-minute devices and we've largely replaced them with Android apps. But, without the calculator, we likely wouldn't be where we are today.

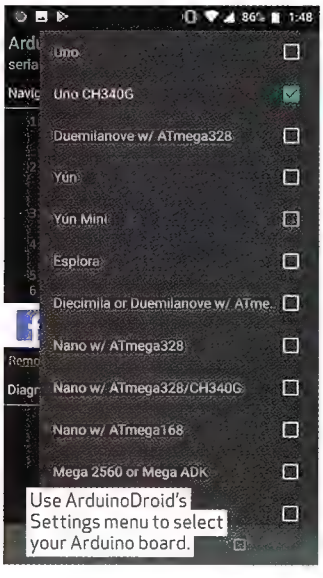
Back in late 1960s/early '70s, portable electronic calculating machines were the 'folding smartphones' of the day. They drove technology development and there were plenty of household names giving them a go, from Hewlett-Packard to Sharp, Casio to Canon. But it was a Japanese calculator company, Busicom, who, in looking to cut production costs for a new model, approached another small tech start-up called Intel that led to the development of Intel's first processor, the 4-bit 4004, in 1971.

However, not long after, calculators gave way to more powerful compact computers. The arrival of two new processors, the 8-bit Zilog Z80 and MOS Technology's 6502, helped kick-start the golden age of home computing during the late 1970s/early '80s with the launch of the Tandy TRS80 Model I, the Apple II and Commodore PET. However, IBM's Intel 8088-powered Model 5150 PC, released in 1981, changed the landscape yet again. Despite the arrival of classic machines like the Commodore 64 in 1982, the home computing era would struggle on in a death spiral of falling prices for a few more years, but there was no denying the PC era had begun.

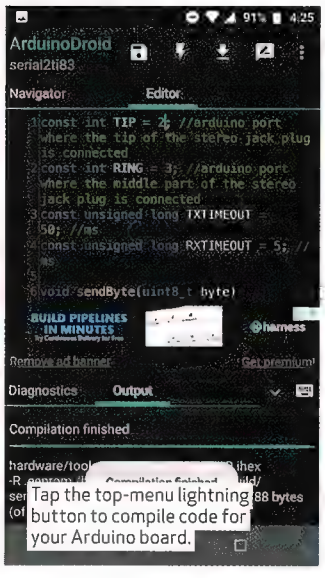
Still, the Zilog Z80 was a capable CPU and continued to pop up in unusual places. It powered a number of coin-operated arcade games, including *Galaxian* and *Pac-Man*. It even powered telephone PABXs and vision mixers in TV broadcasting.

RETRO COMPUTING LIVES ON

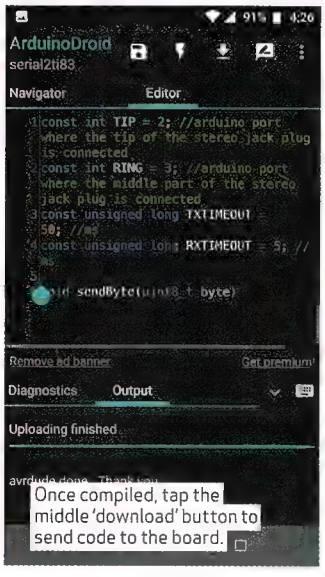
Today, those early home computers fetch serious money on eBay, so much so, it's spawned a new corporate-powered market in retro computing, with the likes of Nintendo and Sony reissuing modern takes on games and



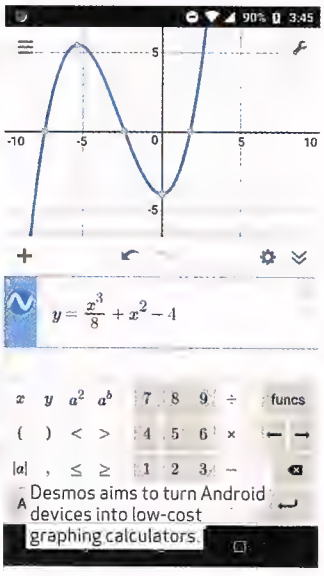
Use ArduinoDroid's Settings menu to select your Arduino board.



Tap the top-menu lightning button to compile code for your Arduino board.



Once compiled, tap the middle 'download' button to send code to the board.



Desmos aims to turn Android devices into low-cost graphing calculators.

hardware of the era. There's also the impending arrival of a new full-sized Commodore 64 to relive those glory days. Feeling that 'retro tech' yearning myself and wanting to relive some 8-bit memories (but without the price tag), I chose a graphing calculator.

Okay, that last sentence no doubt jarred a bit, so let me explain. The types of calculator permitted in maths education in Australia vary between the states. Scientific calculators like the venerable Casio FX82 and its siblings are common, but some Australian states, and especially so in the US, have gone higher up the food chain to graphing calculators.

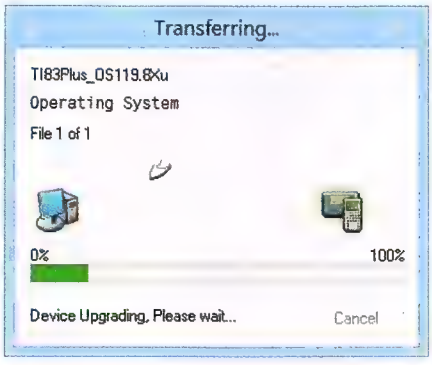
From a purely technology perspective, a graphing calculator is a fairly primitive device up against even a basic modern prepaid Android phone. Nevertheless, they're still pretty awesome if you're a maths or engineering geek. Not only do they solve equations, handle calculus and plot graphs, they're also portable programmable computers, with CPU, RAM and flash storage. HP, Casio and Sharp all have history in graphing calcs, but the 'godzilla' of the market is Texas Instruments and the models that still get mentioned nearly 20 years on are the TI-83 Plus and TI-84 Plus. So why would I choose one of these? Open up the back cover of either one and the CPU inside is... a Zilog Z80 (or in one revision, a clone thereof). The 8-bit CPU that powered the Sinclair ZX-series, Tandy TRS80 Model I – even the Dick Smith VZ200/300 and Australian-designed Microbee – still lives on, rocking graphing calculators powered by four AAA batteries.

Squint hard and the TI-83 Plus reads a little like the Sinclair ZX81 – 6MHz Z80 CPU, 27KB of user RAM, a 96x64-pixel monochrome LCD screen and a 2.5mm serial I/O port. Having 160KB of user flash storage also ditches the need for old-school cassette tapes.

However, search on eBay and you can usually pick up a used TI-83 Plus for under $30 (I bought mine for just $15). The uprated 15MHz TI-84 Plus goes for around $50-$80, but while it comes with a built-in USB port to connect to your PC, the TI-83 Plus doesn't. It predates USB, with Texas Instruments supplying it with a 2.5mm serial port instead.

ROLLING YOUR OWN USB CABLE

Many thousands of these and other models have been produced by Texas Instruments over the last 25 years or so and a strong community has grown up around them, with two sites, TICalc (**ticalc.org**) and Cemetech (**cemetech.net**) the main picks. However, without a USB-to-Serial interface, the Ti-83 Plus has no PC connection. Now you can spend $40 or so and buy a no-name 'grey cable' that links the TI-83 Plus' 2.5mm I/O port with your PC's USB port, but in my case, that would've more than doubled what I paid for the calculator itself, so I couldn't bear the thought of doing that.



We were even able to update the TI-83 Plus' OS using a DIY USB link.

Not surprisingly, there's a solution for this using an Arduino maker board. Head to the GitHub page for 'Serial2Ti83' (**github.com/jw0k/serial2ti83**) and you'll find a project that turns an Arduino Uno microcontroller board into a USB-to-serial converter. You'll need a 3.5mm stereo panel socket, a USB cable for the Arduino board, plus a 3.5mm stereo to 2.5mm stereo audio cable – you'll find these on eBay.

You'll also need soldering skills to solder hook-up wires to the 3.5mm panel socket – if that's not you, rope in a knowledgeable mate who does. Aside from that, putting the thing together is pretty simple. According to the project's author, connect the 3.5mm socket wires so that the 'tip' connects to Arduino Uno pin D2, the 'ring' to D3 and the 'sleeve' to GND. Then, you just plug the USB cable into the Arduino Uno's USB socket and your PC, then plug the audio cable into the 3.5mm socket and your TI-83 Plus.

HOW IT WORKS

Like many gadgets of the time, the TI-83 Plus uses a communications protocol called 'TTL-Serial', which is a bit like the old RS232 protocol used by 9-pin serial ports on PCs before USB showed up. The Arduino board and the GitHub code combine to create a USB to TTL-Serial converter. The TI-83 Plus' Z80 processor only clocks at 6MHz, so the data link is just 9600 baud, or about 1KB of data per second. Still, the TI-83 Plus isn't exactly running Windows here and these are devices designed to do a lot with only a little.

CONNECTING THE TI-83 PLUS TO YOUR PC

We don't have space to go into the full details, but if you have a TI-83 Plus, you can download the latest version of the 'TI Connect' software from the TI ANZ website (**tinyurl.com/y2bu6vje**, version 4.0/2013 and not the 'CE' version). The app is designed to work with various link cables, including the DIY 'grey cable' we have here.

Why bother doing all this? Well, apart from being programmable in its own TI-BASIC programming language, the TI-83/84 Plus can also be programmed in Z80 Assembler, which really makes the most of the Z80 CPU. It cranks up the speed enough to make fun little clones of Tetris, Super Mario, and even Doom, playable on a calculator. If that's not just a little bit cool, what is? Even if gaming on a calculator doesn't do it for you, there are plenty of maths, science and engineering apps available on the TICalc and Cemetech websites – and if you can't find an app, you can always write your own.

WHERE'S THE ANDROID?

Now, since this is strictly an Android masterclass, you're probably wondering what on earth any of this has got to do with Android. Well, here it is – I programmed the Arduino board using my Android phone. You can, too – all you need is 'ArduinoDroid' (**tinyurl.com/y4xubdqd**). It's free on Google Play and essentially is a full Arduino integrated development environment (IDE) that works on any late-model Android phone or tablet with at least KitKat/Android 4.4 and a USB-OTG/host port. There are no other libraries required here, just plug in your Arduino Uno board into your Android device via a USB-OTG cable and launch the ArduinoDroid app. Either copy or type in the 'serial2ti83.ino' source code from the GitHub page, then select your board from the Settings menu, compile the code and flash it to the board.

Obviously, there's no warranty on any of this, so you build it at your own risk. That said, we had no trouble building a more compact Arduino Nano version and it worked a treat.

MAKE DO

The TI-83 Plus is 20 years old now and well superseded by the new $200 TI-84 Plus CE, with a colour 320x240-pixel LCD panel, USB port and new 48MHz Zilog eZ80 processor. I guess some things in tech just live on forever. Yet with free apps like Desmos' online graphing calculator gaining support from some US testing authorities, the future for hardware-based graphing calculators might just be starting to dim a little.

That said, the great thing about Android devices is that they're far more capable than we often give them credit for. Using your phone to program an Arduino board might seem a bit daft, but we're rapidly reaching the point where anything a PC can do, an Android device can have a crack at, too. Using your Android phone to build a USB link to a device that's 20 years old is also pretty sweet. ■

Simple machine learning with Python

We take our first steps into the world of machine learning using the Python programming language. Darren Yates explains how.

Python is arguably the world's favourite programming language, and it's fast becoming the tool-of-choice for machine-learning scientists and engineers around the world. Not only does Python have a simple, easy-to-learn form or 'syntax', it's highly extensible, meaning there's a massive number of libraries you can add to give the language new features. Last month, we wrapped up our quick introduction to the Python language, covering the basics of variables, if-else statements, for/while-loops and functions. This month, we take our first steps into the world of machine learning, using our embryonic Python knowledge on a simple yet well-known dataset to see if we can predict a type of flower just from the measurements of its petals.

GET THE SOFTWARE

Before we start, if you'd like to join in, grab the latest version of Python (3.6 or 3.7 is fine). We're using the Windows release here for simplicity, but you'll find options for Linux and macOS as well. It's available free from **www.python.org/downloads**. Install it and launch the IDLE integrated development environment.

SCIKIT-LEARN LIBRARY

We mentioned briefly before about Python's extensibility – one of the most important libraries for machine learning in Python is 'scikit-learn' (**www.scikit-learn.org**). It contains a wide range of machine-learning functions and bundled datasets ideal for learning. To install it, first, locate your Python installation folder (hint: in Windows, it's usually found in /Users/<name>/AppData/Local/Programs/Python/Python3x). Next, open up the 'scripts' subfolder and launch a command prompt here (hold the left-shift key down, right-click in an empty space of the folder in File Explorer, select 'Open Command Window Here' in the context menu). Inside the command

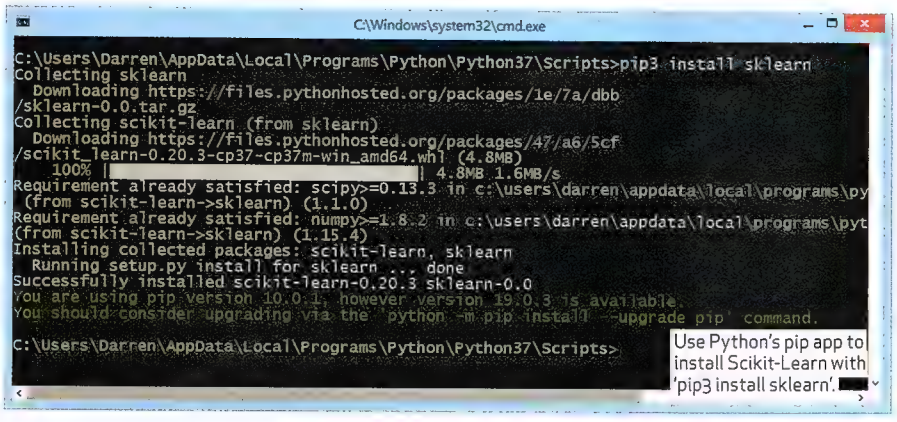
```
from sklearn import datasets
from sklearn import tree
from sklearn.model_selection import train_test_split

print("APC Magazine - Machine Learning with Python - Ep. 3")
print("--- loading 'iris' dataset...")
iris = datasets.load_iris()
print("--- creating the Decision Tree Classifier object called 'dtc'...")
dtc = tree.DecisionTreeClassifier()

print("--- splitting the dataset into 'train' and 'test' subsets...")
X_train, X_test, y_train, y_test = train_test_split (
    iris.data, iris.target, test_size=0.3333, random_state=1)

print("--- building the Decision Tree model from the 'train' subset...")
dtc = dtc.fit(X_train, y_train)
print("--- testing the model using the 'test' subset...")
score = dtc.score(X_test, y_test)
print("--- Classification accuracy:",(score*100),"%")
print("Run complete.")
```

Our first Python code for machine-learning the Iris dataset.

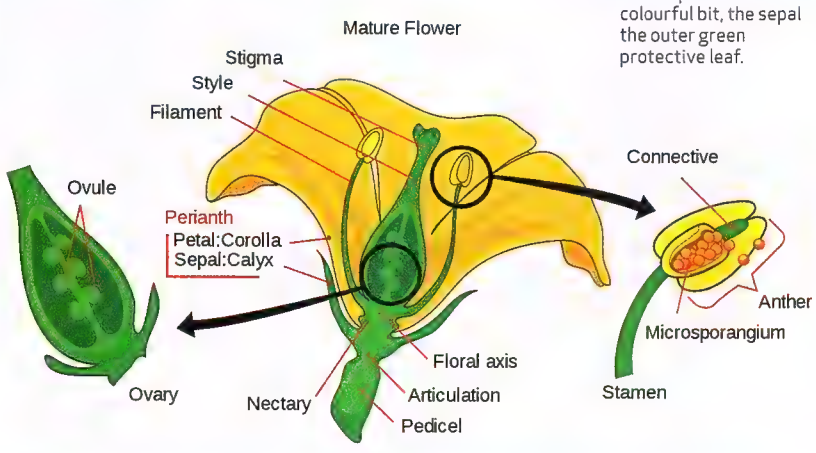
	A	B	C	D	E
1	5.1	3.5	1.4	0.2	Iris-setosa
2	4.9	3	1.4	0.2	Iris-setosa
3	4.7	3.2	1.3	0.2	Iris-setosa
4	4.6	3.1	1.5	0.2	Iris-setosa
5	5	3.6	1.4	0.2	Iris-setosa
6	5.4	3.9	1.7	0.4	Iris-setosa
7	4.6	3.4	1.4	0.3	Iris-setosa
8	5	3.4	1.5	0.2	Iris-setosa
9	4.4	2.9	1.4	0.2	Iris-setosa
10	4.9	3.1	1.5	0.1	Iris-setosa
11	5.4	3.7	1.5	0.2	Iris-setosa
12	4.8	3.4	1.6	0.2	Iris-setosa
13	4.8	3	1.4	0.1	Iris-setosa
14	4.3	3	1.1	0.1	Iris-setosa
15	5.8	4	1.2	0.2	Iris-setosa
16	5.7	4.4	1.5	0.4	Iris-setosa
17	5.4	3.9	1.3	0.4	Iris-setosa
18	5.1	3.5	1.4	0.3	Iris-setosa
19	5.7	3.8	1.7	0.3	Iris-setosa
20	5.1	3.8	1.5	0.3	Iris-setosa

The Iris dataset is a table with rows (records) and columns (attributes).

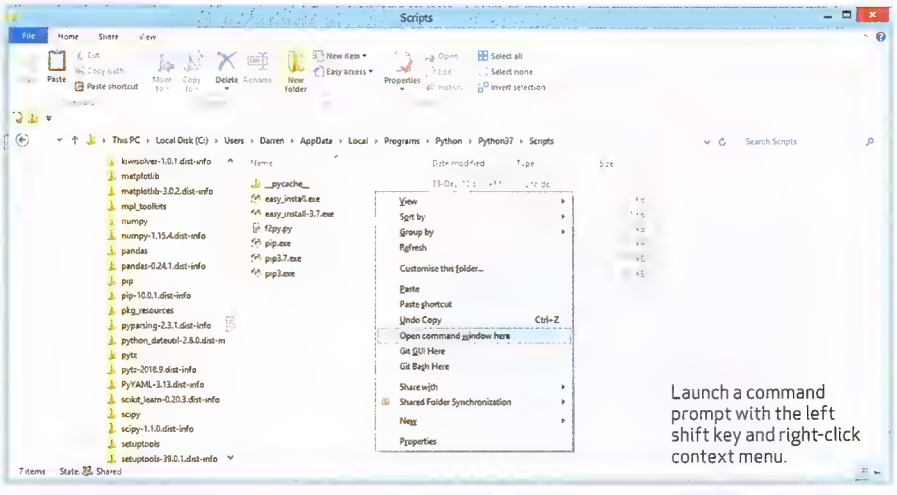
"This month, we take our first steps into the world of machine learning, using our embryonic Python knowledge on a simple well-known dataset to see if we can predict a type of flower just from the measurements of its petals."


C:\Windows\system32\cmd.exe
C:\Users\Darren\AppData\Local\Programs\Python\Python37\Scripts>pip3 install sklearn
Collecting sklearn
Downloading https://files.pythonhosted.org/packages/1e/7a/dbb
/sklearn-0.0.tar.gz
Collecting scikit-learn (from sklearn)
Downloading https://files.pythonhosted.org/packages/47/a6/5cf
/scikit_learn-0.20.3-cp37-cp37m-win_amd64.whl (4.8MB)
100% | 4.8MB 1.6MB/s
Requirement already satisfied: scipy>=0.13.3 in c:\users\darren\appdata\local\programs\py
(from scikit-learn->sklearn) (1.1.0)
Requirement already satisfied: numpy>=1.8.2 in c:\users\darren\appdata\local\programs\pyt
(from scikit-learn->sklearn) (1.15.4)
Installing collected packages: scikit-learn, sklearn
Running setup.py install for sklearn ... done
Successfully installed scikit-learn-0.20.3 sklearn-0.0
You are using pip version 10.0.1, however version 19.0.3 is available.
You should consider upgrading via the 'python -m pip install --upgrade pip' command.
C:\Users\Darren\AppData\Local\Programs\Python\Python37\Scripts>

Use Python's pip app to install Scikit-Learn with 'pip3 install sklearn'.



An Iris' petal is the colourful bit, the sepal the outer green protective leaf.



Launch a command prompt with the left shift key and right-click context menu.

prompt, the path should include this 'script' subfolder. Now run the command: `pip3 install sklearn`. This will download and correctly install the scikit-learn library into your Python installation, so that it's ready for use.

BUNDLED DATASETS

One of the many benefits of scikit-learn is its bundled datasets — these are ready-to-test datasets included so you don't have to go searching on the web, which suits us well. We've used the 'Iris' dataset before, but it's ideal for learning and will make it easier to understand the processes involved. This dataset contains 150 records or 'instances' and five features or 'attributes'. Think of it as a basic spreadsheet, where the instances are rows and each row represents a single entity or event, while the columns represent attributes of that event. In this case, each row is a single example of an iris flower, with length and width measurements of the petal and sepal of that flower making up the first four columns or 'attributes'. The final attribute is called the 'class' attribute and identifies which group each particular Iris flower belongs to. There are three possible class values — Iris Setosa, Iris Versicolor and Iris Virginica, three species of the Iris plant.

There are some important extra things we now know about this dataset, too. First, because each record already has a class value (the value we'll later use machine learning to try and predict), we call this 'supervised learning'. If we didn't have those class values, we'd have an 'unsupervised learning' problem to solve. Second, because there are only three possible class values (the three Iris flower species mentioned above), this becomes a 'classification' task. If we were trying to predict a numeric value from a 'continuous' range of values, it'd be a 'regression' task instead.

Our job is to come up with a set of rules or 'model' from this dataset that allows us to predict the class value of any new Iris flower record presented.

DECISION TREE CLASSIFIER

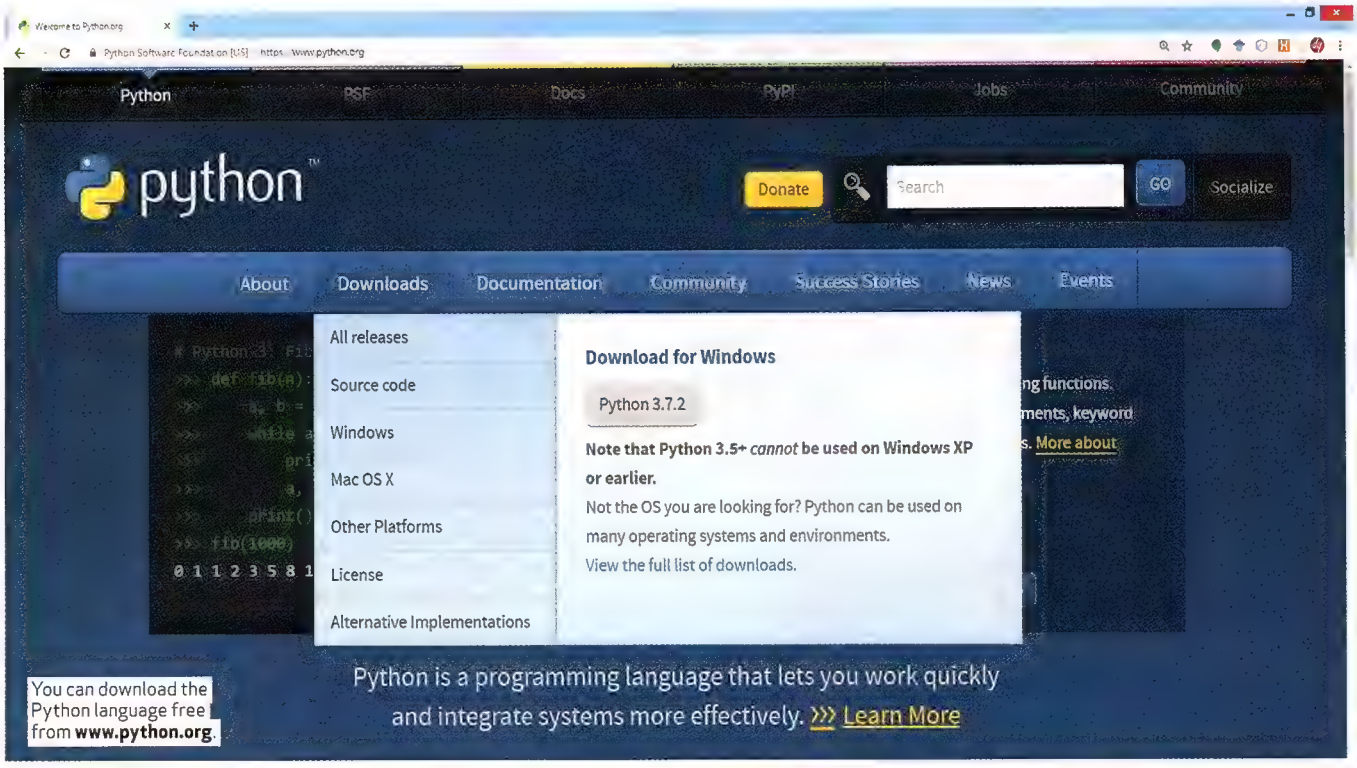
It's been around for 50 years or so in various forms, but the Decision Tree classifier continues to be one of the most popular machine-learning algorithms. That's because it's not only fast, but it produces a visual tree-like structure that's relatively easy to understand without needing to be a domain expert in your problem area.

Imagine you're about to drive to work — each street intersection you reach requires a decision on which direction to take. That decision is usually based on the option that takes you closer to your place of work. If you were to literally map out all the possible road options available from when you leave home until you arrive at work, you'd actually end up with something that looks like a decision tree.

In a decision tree, those intersections are called 'nodes' and the roads that branch out from those nodes are called... 'branches' (see, it's not hard). In a nod to that time-saving tradition, the diagram shows a decision tree from the Iris dataset we prepared earlier (more on this in a minute).

BUILDING A DECISION TREE MODEL

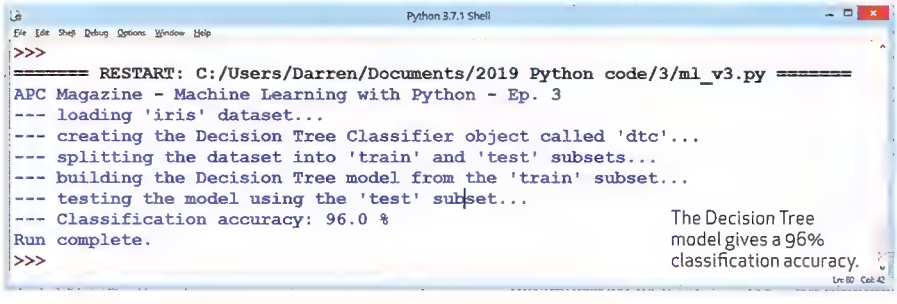
The task of building the decision tree that specifically relates to this 'Iris' dataset is where we apply machine learning. At the start, the decision tree algorithm has nothing but the dataset, so its first



You can download the Python language free from **www.python.org**.

"The algorithm uses a mathematical technique for this splitting test called an 'attribute selection measure', which creates a single numeric value for each attribute."

The scikit-learn website has a wealth of documentation.

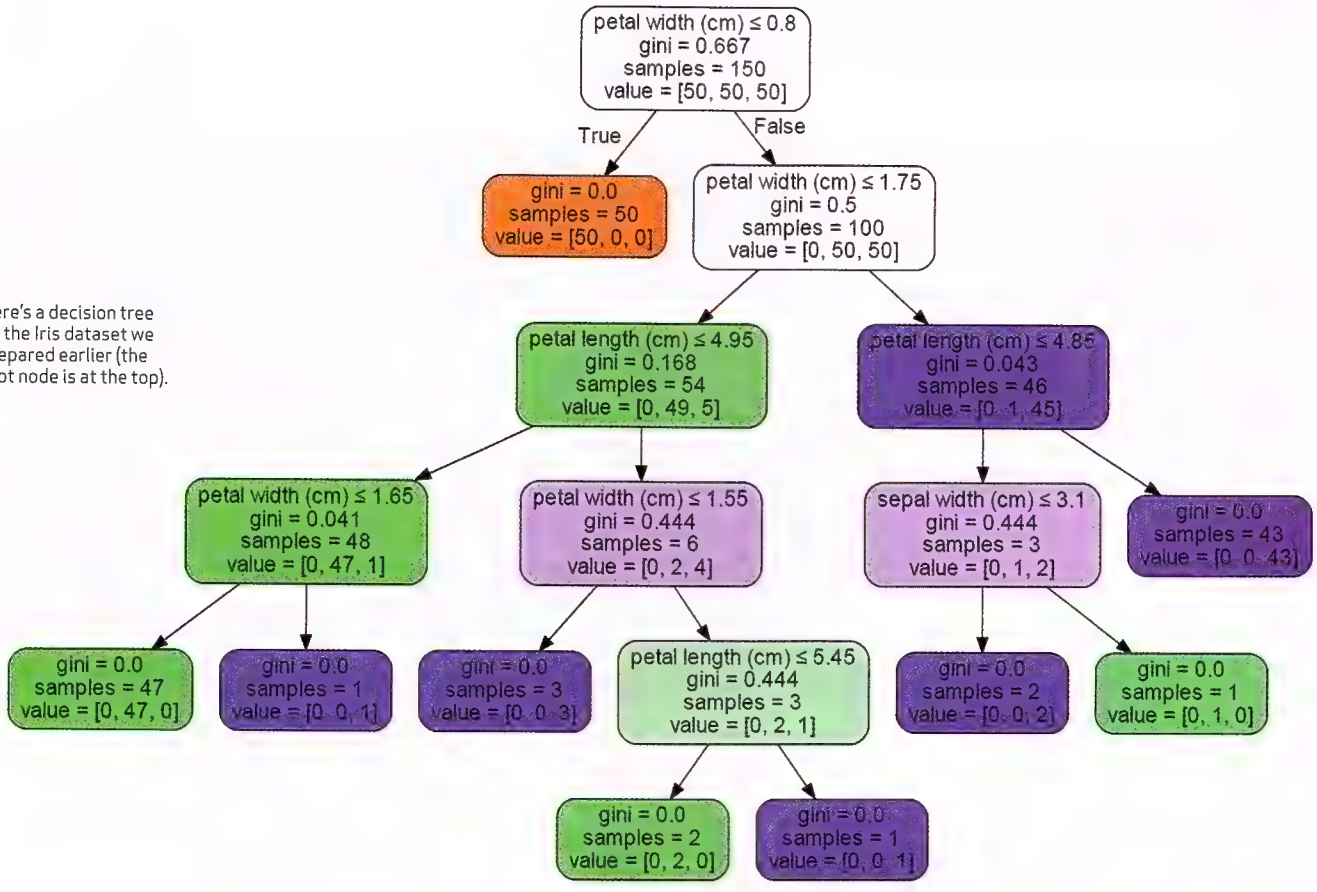

Python 3.7.1 Shell
File Edit Shell Debug Options Window Help
>>>
======= RESTART: C:/Users/Darren/Documents/2019 Python code/3/ml_v3.py =======
APC Magazine - Machine Learning with Python - Ep. 3
--- loading 'iris' dataset...
--- creating the Decision Tree Classifier object called 'dtc'...
--- splitting the dataset into 'train' and 'test' subsets...
--- building the Decision Tree model from the 'train' subset...
--- testing the model using the 'test' subset...
--- Classification accuracy: 96.0 %
Run complete.
>>>

The Decision Tree model gives a 96% classification accuracy.

task is to build that very first node, called the 'root node'. The algorithm begins testing all four non-class attributes of the Iris dataset in turn, searching for the combination of attribute and attribute value that splits the records into the two most distinctly separate or 'pure' groups (this is called a 'binary split'). Remember, each of the 150 records has one of three possible class values – in this dataset, there are 50 records to each class value (in practice, it's not usually this neat).

The algorithm uses a mathematical technique for this splitting test called an 'attribute selection measure', which creates a single numeric value for each attribute. Again, in this case, the lower the selection measure value for an attribute, the more 'pure' the groups the records are split into. The attribute with the lowest score becomes the attribute used at that node.

Look at the decision tree diagram and the root node is the one at the top. Here, the algorithm has found that testing each record on its 'petal width' attribute and whether each record's attribute value is less than or equal to 0.8cm splits the records into two neat groups. Those for which this test is 'true' branch left and those 'false' go right. All 50 records in the 'true' group have the same class value – they all belong to the 'Iris setosa' group. Since no record in this group belongs to either of the other two possible classes, this is a 'pure' division, so it's closed off and called a 'leaf'. In other words, if a flower has a 'petal width' attribute value of 0.8 or less, then



Here's a decision tree on the Iris dataset we prepared earlier (the root node is at the top).

we've learned from the dataset that that flower is definitely an 'Iris setosa'.

That still leaves us with 100 records of the 'versicolor' and 'virginica' classes in the other branch. So, the algorithm goes around again, searching for the attribute and attribute value test for this node that best splits these 100 records into two distinct groups. This time, it decides that the 'petal width' attribute tested at a value of less than or equal to 1.75cm does the job. And again, the records for which this is true are split to the left, those for which it is false go to the right. However, in this case, neither option produces a pure division – of the 54 records on the left, 49 are of the 'versicolor' class and five of the 'virginica' class, while for the 46 on the right, one is of the 'versicolor' class and 45 of the 'virginica' class. Since there is no pure split, the algorithm keeps on splitting each division until it eventually has a set of pure leaves (the end nodes in each branch).

TRAINING AND TESTING

At this point, the tree building process is done. Now we need to test it. There's just one problem. Since we've used all 150 records to train, we can't just use them all again to test – that'd be like sitting an exam with the answer sheet on the desk. In both cases, you'd expect high results, but neither would tell you what was learned.

> "Here, the algorithm has found that testing each record on its 'petal width' attribute and whether each record's attribute value is less than or equal to 0.8-centimetres splits the records into two neat groups."

So in practice, we split the dataset into two 'subsets' – one for training, the other for testing using a 2:1 ratio. That means we train our tree on 100 records and then test it on the remaining 50. As would happen in an exam, the 50 test records are given to the decision tree model we built but without their class values – we know what they are; we just want to see if the model can predict the correct class in each case.

USING A DECISION TREE

We now apply each record of the test subset to the decision tree, branching down using that record's attribute values as appropriate until we hit a leaf. The class value shown in that leaf becomes the predicted class for that record. Once all 50 records have been tested, we tally up the number of records for which the predicted class value matches the record's actual class value, divide it by the number of test records and turn it into a percentage. The higher the percentage, the better.

TRY THE SOURCE CODE

We're going to come back to this next time, but for now, grab the source code pack from the **www.apcmag.com/magstuff** page. After installing 'sklearn' using pip, load the 'ml_v3.py' source code into Python's IDLE and hit the F5 key (run). You should see that we end up with a tested accuracy of 96%, which is pretty good. Take out the print() statements and we've done this with less than a dozen lines of Python code, showing just how powerful the scikit-learn library is. We'll see you next time.

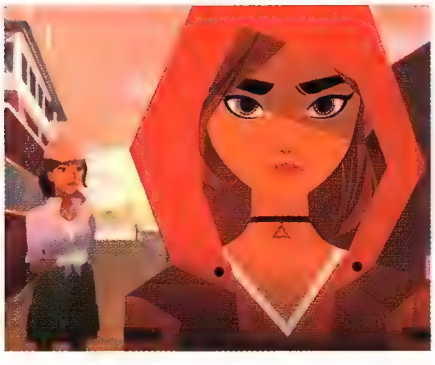
downtime

WHAT'S HAPPENING IN THE WORLD OF FUN.

Esports scholarships are now a thing

THIS ONE CAN GET YOU $5K IF YOU'RE DAMN GOOD AT APEX LEGENDS.

Remember all those evenings of your mum, dad or respective guardian telling you to get off the gaming console and do your homework? Well, in their face, because now it turns out that gaming is actually going to help with your schoolwork. No, seriously, it really is thanks to US school Becker College's $5K *Apex Legends* scholarship. Teaming up with esports groups Team Genji and Helix Esports, the program invites successful applicants to the college to compete in *Apex Legends* to win some much-needed cash.



Google Earth's free game lets you track down Carmen Sandiego

WHERE IN THE WORD IS...

When you open up Google Earth in your browser, you'll notice a little red silhouette of the master thief in the bottom right corner. Once you click on it, you'll find yourself embroiled in the 'crowned jeweled caper', where you'll have to use your sleuthing skills to track down Carmen as she tries to escape across the globe with her loot.

BioWare discusses Anthem's future in new statement

"Our upcoming games will be different from Anthem."

On the heels of BioWare community manager Jesse Anderson's lengthy message to *Anthem's* frustrated community, BioWare general manager Casey Hudson published a blog post addressing *Anthem's* disappointing launch and unclear future. Hudson acknowledged that "there is skepticism out there," but assured players that "there's a lot more work that we intend to do."

"On the one hand it's been a rougher launch than expected," Hudson wrote. "But then as I think back we also knew that big new online games tend to hit some kind of problem once they go live, so as much as we tested and prepared to make sure everything was ready, we were also ready for the possibility that unexpected issues might arise at launch ... We launched a game that so many of you tell us is really fun at its core, but we also had a degree of issues that did not reveal themselves until we were operating at the scale of millions of players. We were of course very disappointed about that, as were many of you."

Call of Duty: Mobile is finally releasing globally this year

YOU'LL SOON BE ABLE TO BLACKOUT'S BATTLE ROYALE ON YOUR PHONE, AS CALL OF DUTY: MOBILE RELEASES WORLDWIDE.

Developed in collaboration with Activision and Tencent, the mobile game is an all-encompassing mash-up of *Call of Duty* history, featuring fan favourite maps in both traditional multiplayer and the series' famed PvE zombies mode.

Tencent is also adding *Call of Duty: Black Ops 4's* battle royale mode, Blackout, to the game as part of its global release, alongside even "more modes of play to be announced soon".

"We are delivering the definitive, first person action experience in a new mobile title with incredible graphics and visceral *Call of Duty* gameplay," said Chris Plummer, VP of Mobile at Activision in a statement announcing the game's release. "Together with the amazing team at Tencent, we're bringing together a collection of the most beloved maps, competitive modes, familiar characters and signature weapons from across this storied franchise into one epic experience for the first time on mobile."

Google Stadia is the first real 'Netflix for gaming' service

"This new generation of gaming is not a box."

Google just made a seriously dramatic entrance into the gaming industry, finally revealing the Google Stadia streaming service at GDC in San Francisco recently. It will launch in 2019 in the US, Canada, UK and "most of Europe." It means massive blockbuster games that you can stream in 4K, 60fps on any device, even your phone, but is it going to replace your PS4 or Xbox One?

What we saw during the demo was impressive. An *Assassin's Creed: Odyssey* clip, but with a Play Now video. Once that was pressed, the game was running on the same device in less than five seconds. Googler 'Khaled' then swapped from phone to laptop to PC to TV with no interruption – the same game just kept going smooth as a buttered otter.

"Stadia is a new video game platform, delivering instant access to your favourite games on any type of screen – whether it's a TV, laptop, desktop, tablet or mobile phone," said general manager (and ex PlayStation boss) Phil Harrison. "Our goal is to make those games available in resolutions up to 4K and 60 frames per second with HDR and surround sound. We'll be launching later this year in select countries including the U.S., Canada, U.K. and much of Europe."

Australia is somewhat absent from this list. Whether this is a casual oversite, or an indicator that our somewhat... problematic broadband network will be unable to handle the service, is yet to be revealed.

> "When we designed the Stadia controller, we listened to gamers about what they wanted in a controller."

GOOGLE STADIA CONTROLLER

The technology works with any controller, but there's also a new Stadia controller that, naturally, has a microphone and Google Assistant built in. It also connects through Wi-Fi directly to the game, and knows what device you're playing on. This electric witchcraft comes in three colours: black white and minty green.

"When we designed the Stadia controller, we listened to gamers about what they wanted in a controller," said Harrison. "First, we made sure to develop a direct connection from the Stadia controller to our data centre through Wi-Fi for the best possible gaming performance. The controller also includes a button for instant capture, saving and sharing gameplay in up to 4K of stunning resolution."

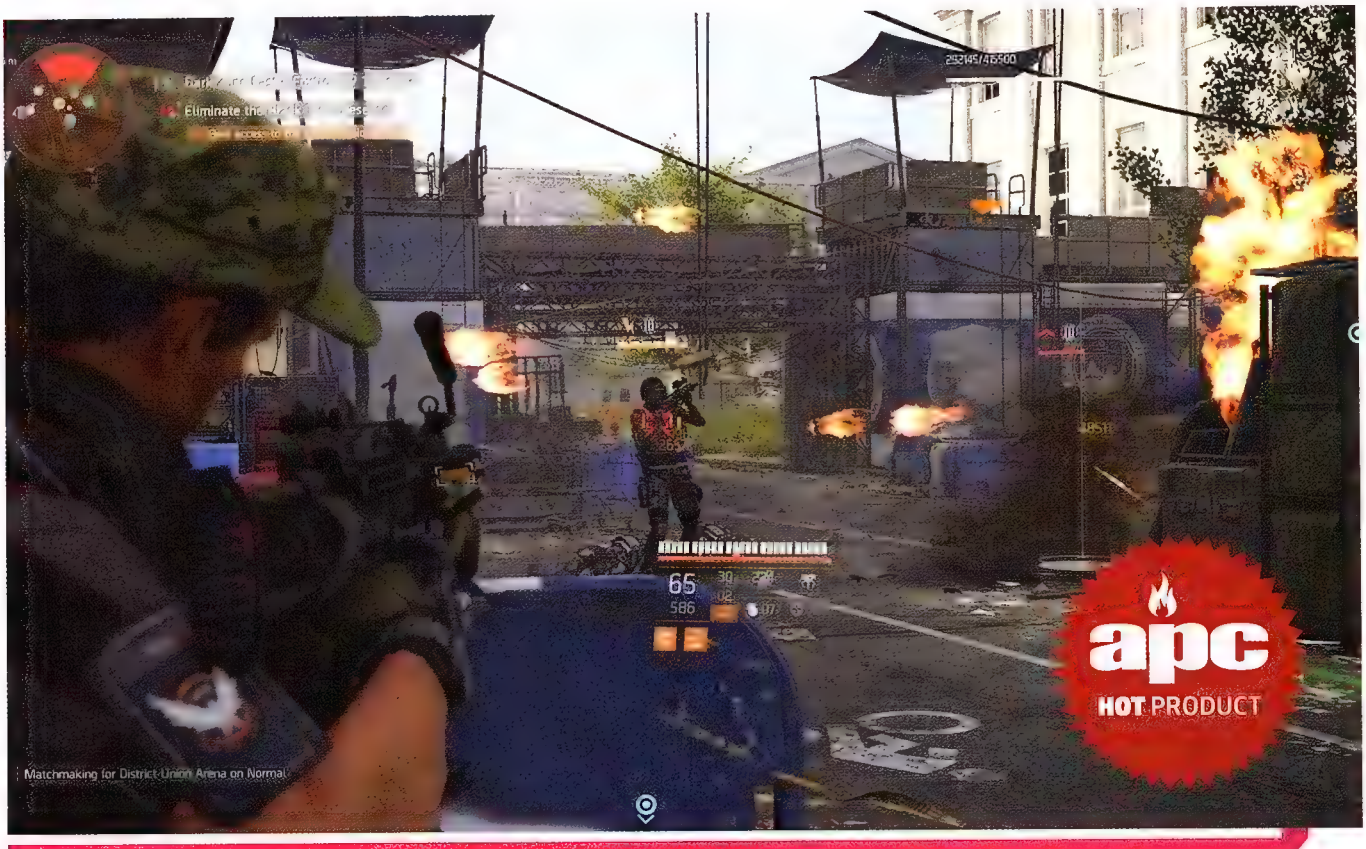
GOOGLE STADIA GAMES

We got to see *Assassin's Creed: Odyssey* in action, and more excitingly, *Doom: Eternal*. Id Software producer Marty Stratton took to the GDC stage to reveal it only took a few weeks to get the game working on Stadia, and that it would run at 4K with HDR and at 60 frames per second. Nurse, my fainting couch!

Of course, getting that sweet 4K is going to depend a lot on the internet speeds you can afford. Notably, the official Stadia store site says "4K HDR at 60 FPS are dependent on your bandwidth. Gameplay experience may vary based on quality of internet connection."

Google also announced its own first party game studio, Stadia Games and Entertainment. Jade Raymond, a familiar face for Ubisoft fans, will run it as studio head. "We are committed to going down the bold path," she told GDC.

"If you look at the games industry today, it's very fragmented," Harrison told Fortune. "You've got people playing on mobile, on PCs, on consoles. I would love for Stadia to unify the screens, so that developers have a bigger audience to create for and gamers have the absolute best quality experience as they play and a seamless link to share what they play and what they stream with their friends." ■



$89.95 | PC, XO, PS4 | STORE.UBI.COM

The Division 2

An hour-eating and frequently thrilling excursion into Washington DC.

The *Division 2* presents a much stronger campaign experience than the first game, with fewer filler missions, and better open world-side activities. Its endgame, too, is a satisfyingly different offering to the preceding hours, remixing levels, making the world feel more alive, and escalating the difficulty of side activities to keep you playing.

It's largely a superior version of the same thing – tough third-person co-op shootouts, interlocking player skills, incremental loot rewards, and a familiarly dry Tom Clancy military tone. It improves in the cadence of its rewards, pelting you with loot and experience points from various sources, and making the next upgrade feel like a natural result of your journey rather than being arduously earned.

It helps that the main mission design is mostly terrific, taking you through a variety of real-world tourist spots for shootouts with the game's three enemy factions: the Hyenas, True Sons and Outcasts, all of which behave a bit differently in combat.

Each main campaign mission feels like a real event. Given that no one really makes linear third-person shooter games now – here they're isolated parts of a massive open world looter game – it's easy to forget what these kind of levels feel like when they're designed well.

There's an amazing excursion into the American History Museum, where there's a (probably tasteless) firefight in the midst of a Vietnam recreation exhibit, complete with royalty-free version of *The End* by The Doors playing in the background. And then there's a gunfight in the Air & Space Museum's planetarium and Mars exhibits which, for a few minutes, make you feel like you're playing a sci-fi shooter.

The choices of setting for the main missions give them a lot of flavour. The longer strongholds that bookend the campaign, with one for each of the three factions, offer the biggest and most exhilarating set pieces in the game.

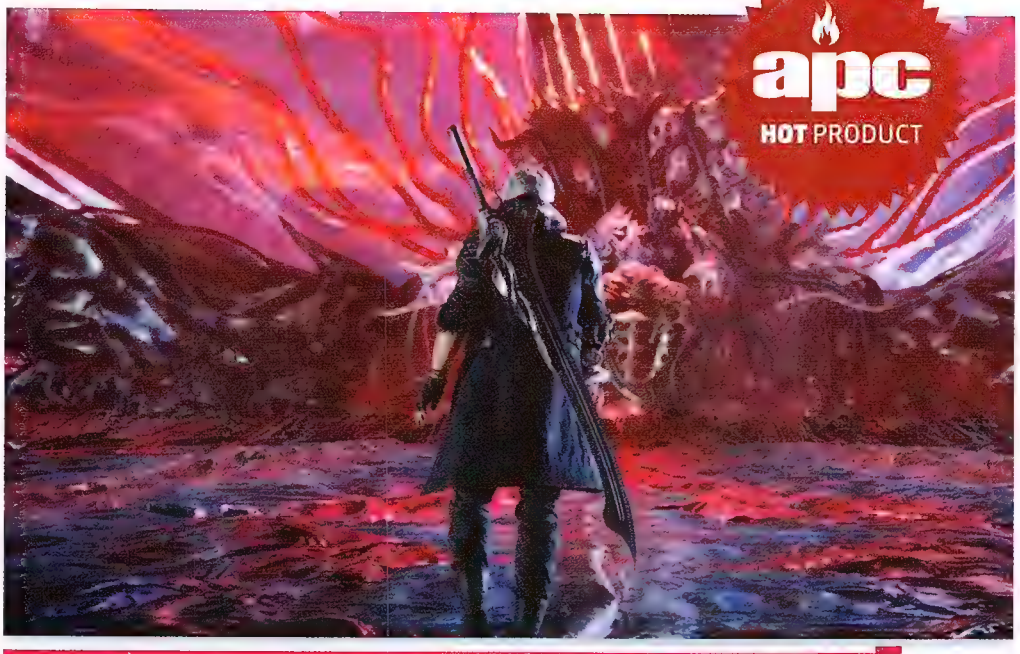
Once you hit the level 30 cap, a new faction called the Black Tusk is added to the game. You then start progressing through World Tiers, which determine the difficulty of the enemies you face and the loot you earn. You'll then revisit most of the earlier main mission locations in their 'invaded' forms, remixed with this high-tech force's new enemy types. These invaded mission variants are a lot of fun, with enemies often spilling out of different parts of the level to your first visit, so they don't feel repetitive.

This is a very complete-feeling follow-up to ***The Division*** from a team that clearly learned a lot about its audience after a series of successful, high-value updates. ■ **Samuel Roberts**

Verdict

A packed, rewarding and frequently thrilling shooter.

★★★★½



$99.95 | PC, XO, PS4 | DEVILMAYCRY5.COM

Devil May Cry 5

One of the best brawlers on PC.

Devil May Cry 5 is a 16-hour exploration of the hundreds of ways a magical man might hit a demon. Nero hits demons with robot arms like a hyper-aggressive Inspector Gadget. Dante hits demons with two halves of a haunted motorbike. V lets demons do the hitting for him. All things considered, *Devil May Cry 5* is one of the best games about hitting demons ever made.

You switch between Nero, V, and Dante across *DMC5's* 20 missions. A demon called Urizen is using a bad tree called the Qliphoth to drain the city of all its blood and it's up to the trio to fight through his minions to stop him. The story is preposterous, genuinely funny at points, and supported by earnest performances and quality performance capture. Though the areas you visit can be simplistic and washed out, it's a decent enough setting for combat encounters.

Each character has their own fighting style, but there's plenty of opportunity to find your own preferred approaches within each moveset. Nero's basic abilities let him attack with his sword and revolver. You can hold the fire button to charge the gun and deliver bullets that can stagger enemies, and you can rev your sword like a motorbike to power it up and access fiery new moves.

Dante can switch between four melee weapons, four ranged weapons, and four combat styles on the fly. All of Dante's weapons are fun, but my favourite is the hat, which captures DMC5's wilful tendency to be incredibly smart and stupid at the same time. You can build your whole combat style around the hat's clever orb switching mechanics.

V is the palate cleanser of the three. He struts around the edges of the battle reading poetry from his book as his pet demons rip up enemies.

I can easily see myself putting in many more hours with this. The setting lacks the flair and imagination of the genre behemoth *Bayonetta*, but there's a greater variety of combat styles and a higher degree of challenge. ■ **Tom Senior**

Verdict

Great characters and a beautiful and fluid combat system — a must-buy for combat fans.

★★★★½

How to be a Tree

Going back to your roots.

FREE | ZAPHOS.ITCH.IO/HOW-TO-BE-A-TREE | PC, MAC

I've come to the conclusion that being a tree is kind of wonderful. For one thing, you're such a lovely tree that a monument is quickly built in your honour. You go on to become an icon of worship for a futuristic society, before the game ends, and without you lifting a finger. You'll be pleased to discover that's just one ending of many, branching out from the innocuous beginning, where you're given ownership of a seemingly immobile totem of twigs. The other endings stem from your realisation that this tree can actually move, tumbling left and right, and jumping up onto floating platforms with all the elegance of the guy from *QWOP* after a litre of gin. Nominally this is a platform game, where you're required to leap about, to collect triangular doodads, and reach the swirly exit portal that will take you to the next level. But it's also, very much like *The Stanley Parable*, a game of hunting down and unlocking multiple endings. ■ **Tom Sykes**

★★★

Bird of Passage

Haunting Tokyo.

FREE | SPACEBACKYARD.ITCH.IO | PC, MAC

Bird of Passage gives you the opportunity to don the white sheet and clanking chains of a g-g-ghost, but without having to die for the privilege. You're a spectre that's been haunting the streets of Tokyo since 1923, when the Great Kanto earthquake ripped Tokyo asunder, and sent you to an early grave. Rather than take up residence in a creepy old mansion, you instead take to the roads, hopping endlessly from one taxi to another, sharing your story – or the bits you can remember of it, at least – over and over again.

As loops go, it's one of the most mesmerising I've seen, thanks to the expertly framed scenes, the graceful animation of the ghost protagonist, and the overall smoothness of action as you enter and exit each taxi.

I thought then that Bird of Passage might be intentionally endless, but there is an ending lurking behind the 'correct' set of dialogue options – and no clue whatsoever what those correct choices might be. That mirrors the experience of the ghost, who has no idea how to move on either, but it is ultimately quite frustrating having to replay the same conversations until you finally 'win' them. ■

Tom Sykes

★★½☆☆

$21.50 | HEMPULI.COM | PC, SWITCH, LINUX, MAC

Baba is You

Pushing and shoving the rules.

Baba is You is a spatial word game, of sorts. It combines programming-style commands with Sokoban-esque block pushing to create hugely inventive and varied puzzles. By rearranging the blocks with words on them you can issue new rules for the world or find new ways to interact with the space. You can even totally rewrite the win conditions for a level.

It's an easier concept to understand by playing than talking, so here's an example. In one level you start as a rabbit in a walled room. Inside the room with you are three text blocks – "Wall", "is", and "stop". They're connected in a straight line so the walls currently stop your character from passing through them. If you nudge any of the blocks out of line the walls no longer stop you and you can walk through.

The blocks which make a win condition for the level aren't yet connected in a line. The simplest solution to that is to push the blocks marked "flag", "is" and "win" into a line. After that, walking to the flag will complete the level. But there are other solutions which immediately start to show you how many possibilities the system involves. You could mix blocks from the first and second room to write "Wall is win". That lets you finish the level by touching any of the walls.

It's an absolute delight. Some levels feel a bit overwhelming but you soon get into the habit of reading them. For example, commands jammed into a corner can't be moved so they act as the basic truths for the scene, narrowing down the possible solutions. If there's space next to them, that might be a hint that you can modify them with an intersecting command. The puzzles then become manageable (even if they're still daunting).

Baba is You deserves its critical acclaim. It's part logic puzzle, part existential quandary, part love letter to how much potential is contained in the building blocks of language.. ■

Philippa Warr

Verdict

Takes the familiar idea of blocks and puzzles in a fresh direction.

★★★★½

apc RECOMMENDS

$TBA | DEVOTIONGAME.COM | PC

Devotion

A chilling and intelligent psychological horror.

Taking place across seven years, *Devotion* is a psychological horror game set in a single apartment in '80s Taiwan. As you progress through it, this claustrophobic living space shifts around you and tells the fragmented story of a family who once lived there.

In one fragment it'll be warm, cosy, and lived-in. In another, moving boxes sit unpacked as a crackling radio plays a Taiwanese pop song. The attention to detail, and the fidelity of the environment, is incredible. Grubby textures, atmospheric lighting, and convincing piles of clutter make for an impressively realistic setting. Despite being developed by a small team, *Devotion* has the production values of something made by a much bigger studio, albeit in a confined space.

Sometimes the things you see in the apartment are more surreal: a red umbrella floating mysteriously in mid-air; a porcelain doll skewered by hypodermic needles; eerie mannequins staring at you with blank expressions, moving when your back is turned. The horror in *Devotion* is subtle, understated, and deeply creepy. It's also a game you'll want to play with headphones because the atmospheric audio is sensational, particularly the use of music and radio broadcasts.But *Devotion* is more than just a ghost story. On a deeper level it's about the tragedy of the people who lived in the apartment – a gravely ill daughter, a husband resentful of his wife's success, and the strain it puts on the family. You view the story through each family member's eyes and Red Candle handles the human side of the story with nuance.

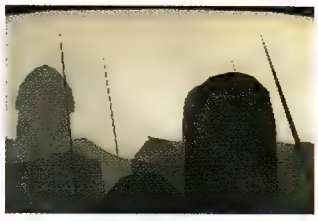
Some of the horror imagery in *Devotion* is a little hackneyed, and stuff you've seen in a dozen other first-person horror games. But when it flexes its imagination and dreams up something of its own making, it can be disturbing.

Devotion's attention to detail, refreshing restraint, and deep, layered storytelling make for a fantastic horror experience, making it one of the best and most unsettling modern horror games. ■ **Andy Kelly**

Verdict

Tense, cerebral, and grotesquely beautiful, Devotion is a deep and disturbing horror experience.

★★★★☆



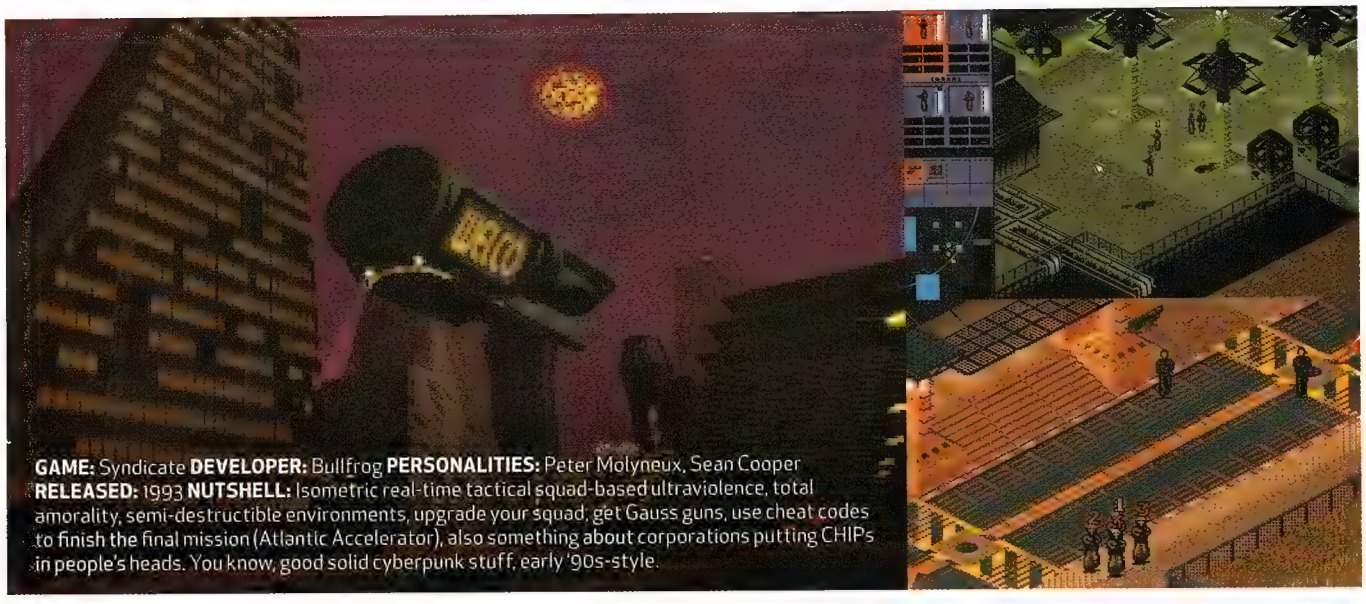
A Knight's Fee

War is hell.

FREE | ANDOS.ITCH.IO PC

A Knight's Fee starts with a premise that's still surprisingly rare in games – actually being involved in a battle would be terrible. This short but effective medieval battle sim isn't your average heroic power fantasy, where you can swing a sword with abandon and chug a potion to instantly heal yourself – you're an ordinary knight, with an ordinarily frail body, and you're lost in a fog of cannon fire and enemies. You begin the game in formation, lined up with your fellow combatants who will soon be on the receiving end of a giant whompy thing that lands like a meteorite. Survive that encounter and you have even bigger problems: the seemingly random crash of cannon fire, and the sudden arrival of enemy infantry through the fog of war. Combat is simple in *A Knight's Fee* – perhaps a bit too simple, as enemies perish in a single hit from your blade. It does the job however, while the generous shield mechanic makes it slightly easier to last long enough to see the end. ■ **Tom Sykes**

★★★☆☆



GAME: Syndicate **DEVELOPER:** Bullfrog **PERSONALITIES:** Peter Molyneux, Sean Cooper **RELEASED:** 1993 **NUTSHELL:** Isometric real-time tactical squad-based ultraviolence, total amorality, semi-destructible environments, upgrade your squad, get Gauss guns, use cheat codes to finish the final mission (Atlantic Accelerator), also something about corporations putting CHIPs in people's heads. You know, good solid cyberpunk stuff, early '90s-style.

Bowling for Eurocorp

How do you get away with releasing a super-violent real-time tactical shooter, where trenchcoat-wearing cyborgs blow away civilians without consequence, where people are depicted on fire and screaming, and mind-controlled innocents become human shields... without it becoming the focus of a massive public outcry? Anthony Fordham says: simple, release it on PC in 1993.

Videogames have been controversial since the early 1970s. Ever since Atari decided to build an arcade cabinet where the joysticks were replaced by pink domes designed to look like boobs which the players... twisted around? (Fact-checks doubtfully – yes, it's true).. certain types have made it their mission to tell us videogames will destroy the Earth.

But grotesque torture game *Chiller* was a 1986 arcade cabinet, and *Death Race* only had stick-figures, so proper ranting-in-the-press controversy had to wait for 1992, which hit the moral majority with the double-punch of *Doom* and *Mortal Kombat*.

One of the clearest signs of gaming's coming-of-age as an artform was when it took over from "violent movies" as the go-to scapegoat. You know, the thing to blame every time another American goes nuts with one of the easily purchased high-powered firearms they have over there.

Like us, you can surely rattle off the titles of the games that copped the lion's share of the blame: *Mortal Kombat* had the gory fatality moves; *Doom* had demons screaming and collapsing in piles of blood and gore; *Carmageddon* let you run over pedestrians; *Postal* was, well, *Postal*; even *Kingpin* copped some flak for its encouragement of, I guess, brutally murdering the violent gang that was trying to brutally murder your violent gang.

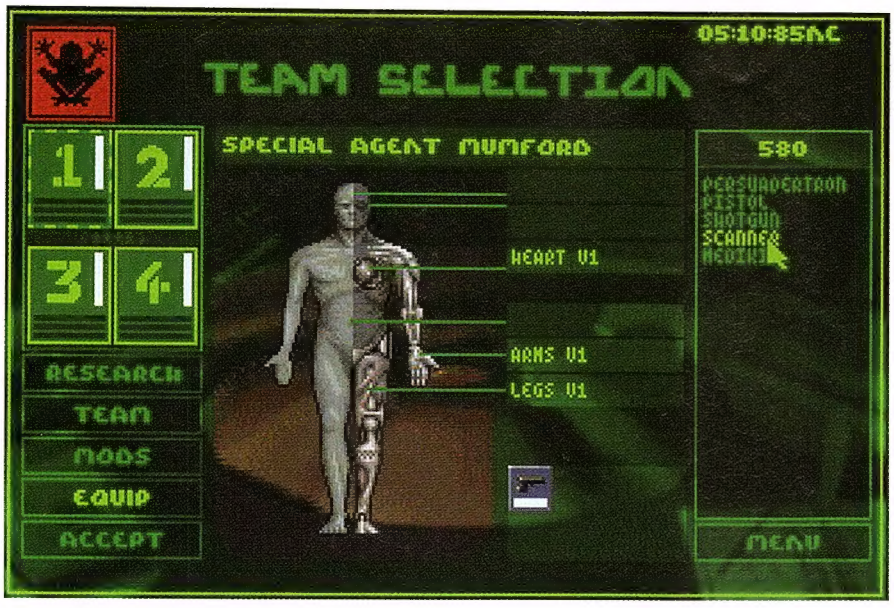
But there's a game missing from that list. A game that made you dress four badasses in black trenchcoats, equip them with high-powered weaponry, and then make them shoot up public spaces in pursuit of various mission objectives – and if a few (or a hundred) civilians got caught up in the firestorm, well, the game just didn't care.

THE OLD ULTRAVIOLENCE

This was what made *Syndicate*, Bullfrog's 1993 cyberpunk(ish) indulgence, so compelling. That you – the operator of a team of agents, out to further the interests of your megacorporation – were given the kind of power and influence to be able to cut absolutely sick in a major metropolitan area with no consequences... assuming your agents made it out alive.

It made *Syndicate* a very different kind of "violent" to games like *GTA*, *Postal*, or even *Carmageddon*. In those games, killing innocent people had an effect. Go nuts in *GTA*, pretty soon you have actual tanks chasing you. In the original *Postal*, the player-character is clearly insane, and ends up in an asylum. And in *Carmageddon*, the entire premise is so bonkers that even Australia's pre-R18+ equipped ratings board cleared it for publication, pedestrian blood and all.

But out of all of these, only *Syndicate* replicates what it's like to genuinely not



have to care about "collateral damage" and the lives of innocent bystanders. It goes even further: the game includes a device called a Persuadertron that causes civilians to gather around your four-'borg team in a tight cordon, grabbing weapons off fallen foes. Target a new enemy, and the civvies will open up or even try to take them out with their bare hands, providing a useful hit-point soak for your guys. The civvies work as human shields.

POWER OF LIFE AND DEATH

And yet, no matter how many civilians you kill, or spare, there's no real impact on the mission. While this is fundamentally due to the technical limitations of PCs in 1993, it paradoxically forces the player to make actual moral decisions. You don't just not kill people because sparing civilians will prevent more baddies from spawning. Rather, the reason you choose to not blow up passing cars is because the sight of people crawling out of the wreckage, on fire, and screaming, feels bad, man.

Certainly for this gamer, *Syndicate* is the first time I can remember watching a panicking sprite-person run jerkily right underneath the crosshair of my minigun... and me deciding not to shoot them. It was the lack of consequence that stayed my hand, the knowledge that it was a real decision. Spare them not because it was in my interest, but spare them as it's the right thing to do.

Sure, it's easy to spare a civilian when you're just walking down the street and no alarms have been raised and your team is not under fire. But what about when everything is going off and there are dudes with flamethrowers coming for you? Can you justify risking one of your squaddies — dead cyborgs were very expensive to replace — simply for the sake of something that is, in many ways, just a background animation?

ROTTING OUR MINDS!

Given all this, and given the way the player's team all wear long black trenchcoats, it seems incredible today that *Syndicate* isn't on the list of blame-games. Perhaps it was the timing. Back in 1993, there hadn't been a mass shooting in a US school since Charles Whitman climbed a tower at the University of Texas in 1966. It remained the deadliest school shooting in the US until Columbine in 1999. In other words, there wasn't that much violence to blame games for.

Mortal Kombat and *Doom* were targeted because they were monstrously popular, and had "realistic" graphics (for the era) and their mere existence frightened the kinds of people who think all new media and art forms are here to destroy the world.

But I like to think it's a bit more than that. See, *Doom* you can look at the box, or see a kid play it for 30 seconds on a demo 386DX at Brashs, and go "Aaiee, demons and blood! Ban it!"

Syndicate, while basic by today's standards (and the standards of its spiritual successor, the Kickstarter-backed *Satellite Reign*), was one of those games that straddled the line between proper PC hex-grid wonk turn-based strategy, and arcade shooter.

In some ways, *Syndicate* did for action-strategy what *Dune II* did for RTS. Neither game was technically the first in its genre, but both streamlined — while avoiding dumbing-down — the gameplay, paring it back to something that had a level of complexity that could only work on PC and its keyboard and mouse.

Watching *Syndicate* playthroughs on YouTube today, it looks even less complex than the average free-to-play mobile game. Equip your dudes with a couple of guns, run around an almost-empty town, shooting everything until the mission suddenly ends.

Yet back in 1993, the mere fact you could run around town, in any direction, and assassinate or kidnap or convert targets or... — well, it was pretty much just those three options — while choosing to slaughter, spare, or even temporarily enslave the general populace, was mind-blowing. ■

Early Molyneux effect

The history of PC gaming is richer for the fact that Peter Molyneux is part of it. It's true he made outlandish claims for what *Black & White* would let the player do, and he later went on to make similar unbackable claims about *Fable*, and something called *Godus* that nobody cares about any more.

Thing is, the Molyneux Effect (in which a developer talks up amazing features that sound impossible to implement, and then when the game comes out, are revealed as having been impossible to implement) was in full force for *Syndicate*. It's just that back in 1993, not as many people were exposed to it.

Molyneux talked up the game's open world, and the way everyone in the world of *Syndicate* had a CHIP implanted in their heads that controlled their emotions, or something.

The claim was that the emotional state of each NPC would be tracked, and their behaviour would change based on how much you (in the form of four trenchcoated cyborg killers) disturbed, you know, the peace. Stroll casually into town, everything's neat as a pin, cars all neatly parked. Start shooting up the joint, blow up a couple of police checkpoints, and civvies would freak.

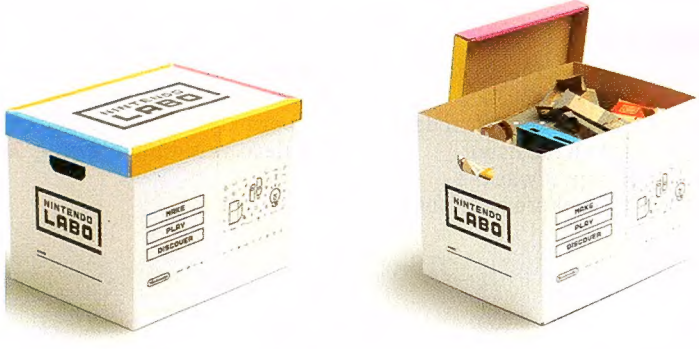
Molyneux said they'd even run home, get their car keys, jump in their car, and try to bug out. You, of course, being a psychopathic gamer, would blow up the car as it passed.

While this kind of AI ain't no thing today, back in 1993 the sheer lack of RAM in the average PC made it fantastical. And it was.

Apple's new titanium credit card will pick up your next tab – but did we really need it?

Apple works out a way to make more money with less innovation.

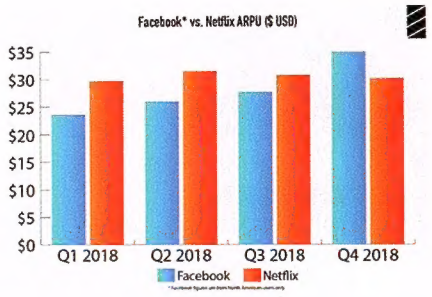
Apple already takes a ton of money – so why shouldn't it look after all of it? There's no doubting that the Cuppertino company hasn't been leading the technological innovation race for the last few years, and in a conference in March it announced it was officially making money its business with a new credit service called Apple Card. Apple Card will, of course, work primarily on an iPhone, but the conference also revealed an exclusive physical titanium card with laser engraving and a bone white colouring that would make Patrick Bateman seethe with jealousy.



Nintendo Labo's latest toy is simply an empty cardboard box

NINTENDO BUILDS A MARIO KONDO BOX FOR ALL YOUR SWITCH ACCESSORIES.

Nintendo's Labo kits are cardboard origami attachments that you use with a Switch console to make the controllers mimic whatever you're doing in-game and, if the latest accessory is anything to go by, they can be rather messy. While the Labo Okatazuke (which translates to "cleaning up" or "organising") is by far the most boring and rudimentary Switch companion product, we suspect Nintendo is channeling Marie Kondo by hoping your new organiser will 'spark joy' in all the Labo items it contains. While it might be a little dull for the kids, this clean toy box is basically the adult version of checkout candy at child height.



Facebook now makes more money per user than Netflix

WE'RE ALL EMPLOYEES OF THE WORLD'S BIGGEST SUBSCRIPTION ADVERTISING SERVICE, AND WE LOVE IT.

With over two billion monthly active users, it's pretty obvious that Facebook is making some serious coin, but what's perhaps a little more surprising is just how much money it makes per person. An article that ran in *The Spring* looked at Facebook's revenue over the last year in the US and noted that it grew 37%, with the local user base only increasing by 9%. This increase in revenue from digital advertising sales actually pushed Facebook's per-user revenue above that of Netflix, an impressive feat when you consider the company relies entirely on donated content that is curated for free by its users. If that isn't satire, we don't know what is.

McDonald's AI uses the heart to get to the stomach

MCDONALD'S THINKS YOU SHOULD HAVE A FROZEN COKE ON A HOT DAY.

Once upon a time, you needed the wisdom of a slightly overweight, slightly underpaid 14 year old to ask if you wanted fries with your Big Mac, but it seems McDonald's has found a more efficient and less hungry employee: AI. After acquiring the machine learning company Dynamic Yield, the golden arches are set to become golden circuitry as it introduces self-serve ordering screens that will use AI to identify and recommend the items you promised you wouldn't get this time. Factoring in everything from the time of day to the most common accompaniments, McDonaldsNet knows exactly what you want, and when you want it. Maccas' CEO described it as a "win-win-WIN technology", which means everyone's a winner. ■

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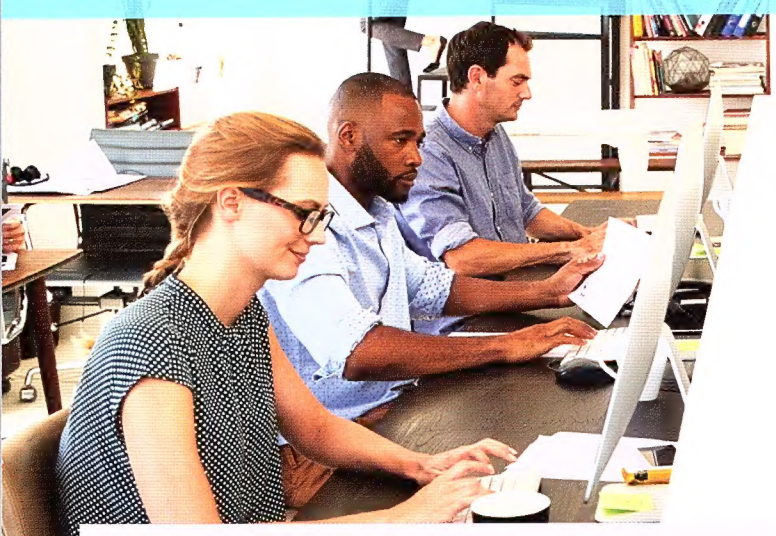

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